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REPORT ON MARS, NO. 41.

By WILLIAM H. PICKERING.

Drawings of the Apparition of 1926.

Of the fifteen sets of drawings sent to me since this apparition, I am publishing the two best complete sets, a combination of two others of exceptional excellence, both of which were incomplete, but which supplemented each other very nicely, and my own. All the larger reflectors gave results nearly equally good, and all were inferior to those given by the three refractors, but I finally decided to replace a more artistic set of drawings than mine, the former of which I had at first selected for this Report, because mine gave the details more definitely and the confirmed canals were rather more numerous. With regard to the instrumental equipment of the various observers, in addition to his 8-inch refractor, Mr. Phillips often used a 12-inch reflector for confirmatory purposes, and once used it exclusively. Mr. Ellison similarly occasionally used an 18-inch reflector, but in both cases the main reliance was placed on the refractor. Particular attention is called to the two drawings by Mr. Hargreaves made with a 6.5-inch reflector. He sent others which were very good indeed for an instrument of that size, but these two I think are worthy of especial mention.

My examination and marking of a drawing for excellence depends mainly on the number of canals and other fine detail shown upon it that are corroborated by other observers. I next subtract the number of canals shown that are not corroborated. This plan is not carried out with mathematical precision however, for if the set is a very good one, I assume that the observer saw clearly several unconfirmed canals, though not many, which were really there. On the other hand if the set is of a lower grade, and contains a good many well known canals that other observers did not see at all, I cut it pretty severely, on the theory that although these canals were undoubtedly thought to be seen, their actual existence is not assured, and it is believed in any case that they were not seen well enough to justify their insertion on the drawing. A certain weight is given to the general appearance of the drawings, as to whether the shapes of the larger details agree well with what is seen by others. Here again it is best not to be too precise, because changes sometimes occur even in the course of a month, and if two drawings are made a month apart, as is often the case, the difference in detail may perhaps be real. This can often be decided by means of other drawings made at about the same time. Again if the longitude of a drawing

differs materially from the desired longitude, that counts against it. English observers are unavoidably somewhat at a disadvantage here, since so many of their nights are cloudy. On the other hand, American observers east of the Mississippi, and especially in the north, are at a hopeless disadvantage, because their seeing is so poor.

The precise time when each desired longitude will cross the central meridian of the disk should be carefully calculated before hand, as described in Report No. **27**, POPULAR ASTRONOMY 1924, **32**, 335, and the drawing begun as nearly as possible at about five minutes before that time. This will insure that the more striking details will be properly located. Earlier writers often recommended that the observer should never know beforehand when he drew the planet, what longitude was central. This would be absurd however now-a-days, when everyone at all familiar with Mars can tell at a glance what portion of its surface is on the meridian. If the details are not clear enough to show that, they are not worth drawing at all. Planetary astronomers are now far beyond that period of the investigation. If a drawing is a poor one in spite of great detail, and contains much imaginary material, or is in part drawn at the telescope from recollections of earlier drawings or maps, that fact is easily detected. Another point to be considered in the examination of the drawings is their conformation to what is now the accepted standard, as shown in the better drawings published in this Report. While a drawing may be accepted if its coarser and more conspicuous canals are put in their proper places, yet any drawing which represents such canals as narrow straight lines is at a distinct disadvantage. The almost universal opinion of the best modern observers is that that is not the way the canals appear when well seen. It merely indicates poor draughtsmanship. The bounding of a dark region by an extremely narrow canal, while it may possibly sometimes be objective, is in most cases believed to be simply a subjective phenomenon due to contrast, strongly influencing certain observers. The very narrow double canals which are an analogous feature are all ruled out as imaginary, and due also to contrast. Finally, although of less importance in a scientific investigation, an observer should be willing to spend enough time on his work to furnish a properly finished drawing, with smooth darkened surfaces, and not send in a rough sketch for publication.

The seven apparitions since 1913, when these Reports began, carry the planet around through its entire orbit, and we have now therefore seen it at every season of the Martian year. When my next Report appears it will be found that Professor Douglass and I have each furnished drawings in all six longitudes of the planet for the seven apparitions. Mr. Phillips and Mr. Wilson have each sent in similar sets of drawings for five apparitions, but no other observer has furnished them for more than three. Through 1922 Douglass observed five apparitions with an 8-inch refractor belonging to the Harvard Ob-

servatory, which was loaned him by my brother, and by means of it recorded more confirmed canals than any other observer. After my brother's death Harvard required the refractor returned, in order that it might be loaned for variable star work. Douglass succeeded, however, in replacing it with a 36-inch reflector by a manufacturer of the first class, so that his observations were not interrupted. This was most fortunate, but I regret to say that for Martian work that instrument appears to be distinctly inferior to the little refractor, so that Douglass' drawings are not now, what they used to be, as determined by the number of confirmed canals seen.

After my retirement for age in 1924, Harvard permitted me to keep their 11-inch Clark refractor here for another six months, in order to complete my observations for the sixth apparition, but it was impossible to keep, or hire it for two years longer, so as to enable me to complete my series of observations for the planet's year. An effort to buy it at a fair price was also unsuccessful. I consequently purchased a 12.5-inch reflector by one of the world's leading manufacturers, but as in the case of Douglass, I find that my present drawings are not at all of the quality that they were formerly, and we neither of us now can see more than the average amount of detail, as compared with observers favorably situated elsewhere. In short, the definition of my telescope has not at this past apparition proved itself good enough to enable me to take advantage of the excellent seeing that is found in a tropical latitude.

As a result of a thermometric investigation, which will be described in a future paper, on the definition of reflectors, I have found that by encasing the upper end of the telescope in wood, and placing a thin wood-fiber tube inside of it, reaching down as far as the supports of the flat, so as to keep that end as warm as possible, I obtained improved definition. A wire netting having a one-quarter inch mesh placed over the opening further improved the seeing. It also gave an illuminated field on which the web in the eye-piece was visible. If an index is attached to the netting, and the tube graduated to 360°, the position of the spectra shown forms a convenient method of measuring position angles, which is sufficiently accurate for many purposes. Reducing the aperture from 12.5 to 10 inches, nearly always gave improved results. A magnification of 340 was used on all the best nights, but a lower power is best for Martian clouds, and other coarse but faint detail. A 6-inch electric fan sending a current of air through the window near the mirror, and up through the tube, was later found to give greatly improved results. Unfortunately this was not tried until after the apparition was over.

As far as can be judged ,all the more favorably situated observers using reflectors large or small, saw about the same amount of detail at the last apparition. While there was not a great deal of difference between them, exceptionally favorable conditions or a poor night was occasionally shown. There seemed to be a fixed limit of definition placed

on these reflectors of whatever size, above six inches, which none of them could pass. I hope, however, by means of the electric fan to raise this limit somewhat at the coming apparition. The same thing seems to be true of refractors of a size above 10 inches, but their limit of definition is at present distinctly higher than that of the reflectors. An exception to this rule appears to be necessary in the case of the 100-inch reflector on Mt. Wilson. This instrument is furnished with an open-work tube, and a study of well known lunar detail, which I had an opportunity to make with it, and which I hope to describe later, leads me to believe that with favorable seeing it should give results quite comparable to those of the best refractors.

It is I think regrettable that not a single observer should have been able to draw the planet through the seven apparitions with the same instrument. This would have made statistical studies of the canals and lakes throughout the planet's year possible, as the drawings would then have been properly comparable. The same is true of other studies, such as the seasonal changes of cloud, haze, and vegetation. Another reason why I regret that Douglass's and my observations are not now up to our former standard is because in 1924, when it first became possible to compare Hamilton's and my observations with those made with the Lick 36-inch refractor, they were found to be comparable, and we were thus able to confirm many of Dr. Trumpler's canals and other of his fine detail, which otherwise, since no one else could see them, would have had to be classed as "unconfirmed." It is to be hoped that before the next apparition of 1931 arrives some observer with keen eyesight, and favorably located, will have secured a moderate sized refractor, of 12-inch aperture or over, and thus be able to confirm and supplement the detail seen at Mt. Hamilton. Private information implies that this may even be done this year in Japan. In the meantime the two other observers who used refractors, and whose results are recorded here, have evidently done good work in this direction. The various canals and lakes seen by all of these observers will be identified later.

As in our Reports pertaining to the six previous apparitions, the drawings are arranged in the order of the longitudes of the stations from which they were obtained, beginning with the European ones. All the drawings in the same horizontal row represent approximately the same Martian longitude. In the vertical columns the longitudes are intended to differ by 60°, beginning with longitude 0°. Thus six views of the planet are shown by each observer, covering the whole visible surface. These six regions are indicated by the letters **A**, **B**, **C**, **D**, **E**, and **F**. The names of the observers, their location, equipment, etc., are as follows:

Ph Rev. T. E. R. Phillips, Epsom, England. 8-inch refractor by Cooke and 12.2-inch reflector by Calver. Magnifications 211, 282, and 350. Seeing on the Standard Scale ranging from 5 to 9. (For a 7-inch refractor 11 is perfect, and for an 8-inch it is nearly the same).

H F. J. Hargreaves, Esq., Kingswood, Surrey, England. 6.5-inch reflector, maker unknown. Magnification 320. Seeing not recorded.

E_3 M. A. Ellison, Esq., Armagh, Ireland. 10-inch refractor by Grubb. Magnifications 275 and 400. Seeing not recorded. (The Ellison family appears to be devoted to Mars. This is the third member of it whose drawings I have published, hence the subscript).

Pk Professor W. H. Pickering, Mandeville, Jamaica, B. W. I. 12.5-inch reflector by Calver. Aperture actually used, 10-inch. Magnification 340. Seeing on the Standard Scale ranging from 7 to 10.

T Dr. Trumpler, Mt. Hamilton, California, U. S. A. 36-inch refractor by Clark. Magnifications 270, 350, and 520. Seeing 2, 3, and 4 on a local scale of 5.

In Table I is given a statement of the main facts relating to the various drawings. The Table is arranged as in previous Reports, the successive columns giving the number of the figure, the designation of the observer, the aperture of his instrument, the magnifications employed, the seeing on the Standard Scale, which is described in Report No. **9**, the date of the drawing in Universal Time, the region depicted, the longitude of the central meridian, its deviation from the desired standard, the latitude of the center of the disk, the angular diameter of the planet, the longitude of the Sun as seen from Mars, as described in the *Ephemeris*, and the corresponding Martian Date taken from Report No. **10**.

TABLE I.

FUNDAMENTAL DATA OF THE FIGURES.

Fig.	Ob.	Apr.	Mag.	S.	1926	R.	Long.	ΔLong.	Lat.	Diam.	☉	M. D.
							°	°	°	″	°	
1	Ph	12.2	282	8, 9	Oct. 19.1	A	6	+ 6	—14.0	20.2	303.8	Jan. 11
2	H	6.5	320	—	Nov. 25.0	A	0	0	—19.5	17.6	324.9	Jan. 47
3	Pk	10	340	10	Oct. 24.2	A	4	+ 4	—14.8	20.4	306.7	Jan. 16
4	T	36	350	3	Oct. 26.3	A	3	+ 3	—15.1	20.4	307.9	Jan. 18
5	Ph	8	211	7	Oct. 6.9	B	74	+14	—12.6	19.1	296.7	Dec. 54
6	E_3	10	275	—	Nov. 16.0	B	73	+13	—18.5	19.0	319.9	Jan. 38
7	Pk	10	340	8	Nov. 27.2	B	60	0	—19.7	17.3	326.0	Jan. 49
8	T	36	350, 520	2, 4	Oct. 23.3	B	55	— 5	—14.5	20.3	306.1	Jan. 15
9	Ph	8, 12.2	211, 219	8	Oct. 1.9	C	121	+ 1	—12.4	18.4	293.7	Dec. 49
10	E_3	10	275	—	Nov. 5.9	C	139	+19	—17.0	20.0	314.2	Jan. 28
11	Pk	10	340	7	Nov. 17.1	C	119	— 1	—18.6	18.8	320.4	Jan. 39
12	T	36	350	3, 4	Oct. 17.4	C	136	+16	—13.8	20.4	302.6	Jan. 9
13	Ph	8	211	5	Sept. 25.0	D	194	+14	—12.3	17.6	289.5	Dec. 42
14	H	6.5	175	—	Dec. 11.9	D	175	— 5	—20.4	14.8	334.1	Feb. 7
15	Pk	10	340	10	Nov. 11.1	D	182	+ 2	—17.8	19.6	317.0	Jan. 33
16	T	36	350, 520	2, 4	Nov. 16.2	D	162	—18	—18.5	18.9	319.9	Jan. 38
17	Ph	8, 12.2	211, 282	8, 9	Oct. 26.9	E	242	+ 2	—15.2	20.4	308.5	Jan. 19
18	E_3	10	275	—	Oct. 30.0	E	230	—10	—15.8	20.4	310.2	Jan. 22
19	Pk	10	340	10	Nov. 4.1	E	242	+ 2	—16.6	20.2	313.1	Jan. 26
20	T	36	270, 350	2, 3	Nov. 10.3	E	233	— 7	—17.6	19.6	316.5	Jan. 32
21	Ph	8, 12.2	211, 282	7, 8	Oct. 19.9	F	287	—13	—14.2	20.2	304.4	Jan. 12
22	E_3	10	270, 400	—	Oct. 21.0	F	302	+ 2	—14.3	20.2	305.0	Jan. 13
23	Pk	10	340	8, 10	Oct. 27.1	F	299	— 1	—15.3	20.4	308.5	Jan. 19
24	T	36	270, 520	4	Nov. 2.2	F	290	—10	—16.3	20.2	312.0	Jan. 25

The most conspicuous change that occurred in 1926 as compared with the apparition of 1924 was the broadening and darkening of Pandora,

as shown in Figures 1, 2, 3, and 4. It was also dark in 1922. It has thus appeared dark in Martian September and January, but faint in 1924 in November as well as at all other apparitions. On account of the uniformity of the temperature in different latitudes, and the mildness of the Martian climate, as compared to that of the Earth, vegetation in general usually begins to develop at about the time of the equinoxes. In 1892 Pandora was dark in Martian October and November. I am inclined to believe therefore that the faintness of Pandora in 1924 was due merely to cloudiness in the Martian atmosphere, but that at the four other apparitions when it was faint, the faintness was due to lack of water, and other wintry conditions. The most extensive change observed was in the canal system and maria between longitudes 200° and 290°, that is, between Charontis and the Syrtis, including the canals surrounding Elysium. A smaller area of marked change is about Thaumasia, already described in Reports Nos. **35**, **37**, and **39**. In the lower longitudes indicated by the letters **A**, **B**, and **C** under the drawings, there seems to have been a darkening and broadening of the desert canals in the northern hemisphere. Indeed, throughout this hemisphere various changes more or less conspicuous occurred.

Observer's Remarks.

Mr. Hargreaves states that on October 23 and 26 the prominent canal Cerberus was invisible, but that by October 31 it had reappeared and "remained on view throughout the rest of the apparition." Dr. Trumpler states that two brilliant white spots do not stand out sufficiently brightly on his drawings. One is Thule 2, to the right of the polar cap in Figure 16, which was nearly as bright as the cap itself. The other was a brilliant white spot covering most of Libya in Figure 24. This was clearly seen in Jamaica, and is shown in Figure 23 of the same square-cornered shape. Phillips and Ellison, respectively, in England and Ireland saw it quite differently, Nepenthes being much more pointed towards the south. The interval which had elapsed between Figures 22 and 23 was only six days.

Mr. Phillips points out a number of interesting changes noted upon the planet, in several instances evidently due to clouds, which seem to have been very prevalent over the southern hemisphere during Martian January. His obsrvations showing striking changes in Thaumasia have already been described and partly illustrated in Report No. **39**. His drawing of the same region made one month later is shown in Figure 5. The curious triple appearance of the Solis is doubtless due to two clouds, one of which is faintly indicated in Figure 8, also drawn in October, while its meridional extension, unknown previous to this apparition, is confirmed in all the other figures of regions **B** and **C**. Among Mr. Phillips' earlier observations was a cloudlike extension from the terminator on September 4, independently confirmed by Mr. B. M. Peek, some of whose drawings will be shown in a later Report. Numer-

ous clouds over the Syrtis region were seen on October 26, which are well shown in Figure 21. The shapes and location of some of these areas are of interest. The one over Ausonia gradually changed from a rounded to a square marking in Figure 23. Twelve days elapsed between Figures 22 and 24. If the clouds southwest of Euxinus were visible during all that time, they certainly were not recorded by me in Figure 23.

On October 30 a white cloud was seen by Mr. Phillips over Hellas, where a previous one had been noted here in 1924, and confirmed by Dr. Van Biesbroeck. It is described at some length in Report No. **34**. November 2 an unusually brilliant limb cloud covering the Syrtis was also noted. This was seen here upon the same date, and later by Dr. Trumpler. When these clouds disappear they are nearly always replaced by a "gray mistiness" as Mr. Phillips expresses it. We may interpret this that as having deposited their moisture as rain, and having disappeared, the land which they had concealed now presents due to the moistening, a darker color than before, such as is seen in some of the wider canals. He notes that Cerberus, which had previously been hidden, reappeared upon October 31. This date is the same as that given above by Mr. Hargreaves. Ellison shows it, however, in his drawing of October 30. On the other hand, my drawing, Figure 19 made on November 4, agrees with that of Phillips made on October 26. There appears thus to be an alternation in the appearance of the canals in this instance. On December 2 Phillips states that the Syrtis region was still found to be cloudy, Nepenthes and Thoth being almost completely concealed, but the canal Amenthes had now appeared as a straight meridional line. On December 4 he says "the peak of Mare Hadriacum is seen curiously bent over toward the west." It appeared indeed like a canal of rapidly diminishing width following the course of Peneus. See all the drawings of Region **F**. He states also that Nepenthes now runs nearly "straight out from Syrtis, not strongly curved as before." This is shown clearly in Figures 23 and 24, and would imply an increased velocity of the wind, on the theory that these broad curved canals are due to storm tracks in a general planetary circulation. On December 19 he noted "a general pallor affecting all the markings of the disk," presumably due to a universal haze affecting the whole planet. On December 22 I recorded "all detail except Sirenum difficult and extremely faint."

What May Be Expected at the Coming Apparition.

The opposition of 1928 falls on December 21, but the planet is nearest the Earth six days earlier, when its diameter reaches 16″.0. This is less than two-thirds of what it was at the nearest recent opposition in 1924. However it will not appear to us to be so large again even as 16″ before the year 1937. Opposition this year occurs at solar longitude 1°, or almost exactly at the vernal equinox of the planet, which we have dated

on our planetary calendar as Martian Date March 1. Both hemispheres north and south will therefore be equally well seen. The planet's declination will be +26°.6, which is almost as far north as it ever reaches. On November 8 while the apparent size of the planet is increasing, the solar longitude will be 339°.4 and its diameter 13″.3. In 1926 while its apparent diameter was decreasing, its solar longitude and its diameter were the same. Therefore before November 8 at the same season of its year, the planet was nearer us in 1926, but after November 8 it will be nearer us, and we should therefore see it better in 1928.

All of my drawings made in December and January of 1926 between solar longitudes 330° and 0° show unusual, but coarse detail. This is due in part to very cloudy weather on Mars, but also to extensive temporary darkening of its northern hemisphere. Similar observations were made here at the same Martian season during October and November of 1913. This would seem to imply rainstorms in that hemisphere on Mars, in short a planetary rainy season. Any observations for or against that view made at the coming apparition should be of interest. It is likely for this reason to be a particularly poor time this year to look for canals, although next year after opposition they should begin to appear. On the other hand those who begin observing as early as the middle of October, when the planet has already attained a diameter of 11″, should have an opportunity to watch the birth of the three great marshes or tundra surrounding the northern polar cap. This will be an easy and an interesting observation. The largest of these marshes, Acidalium, is comparable in size, although smaller, than the great marsh occupying the western end of Siberia, which covers about half a million square miles, and becomes liquid at the time of the melting of our own polar cap. Similar extensive marshes form at the same time in the northern portions of the American continent. The chief distributing canals from the Martian tundra leading to the northern maria, when they do form, should be large and conspicuous. It is most important that their radii of curvature should be carefully and accurately drawn, since they give us a measure of the velocity of the winds in the upper atmosphere of the planet, see Report No. **19**.

A great variety of color visible on Mars should be a feature of this apparition. Besides the customary yellow, orange, white, and gray, we should also see conspicuous areas of light and dark green, light and dark blue, and brown. These latter colors are readily studied by the light of an electric lamp, which should be held at a distance from the paper so that the latter shall appear about as bright as the polar snow-cap, or if that is not visible, the brighter clouds. A black paper mask containing a round hole of the proposed size of the drawing of the planet may be used to advantage in making colored sketches. In order to study the yellow and orange it is necessary to place two or three sheets of very light blue glass in front of the lamp, and the latter should be of at least 20 watts, in order to illumine the paper to equality with the

Fig. 13
Phillips 194° D

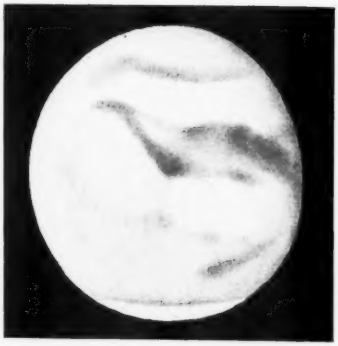

Fig. 14
Hargreaves 175° D

Fig. 17
Phillips 242° E

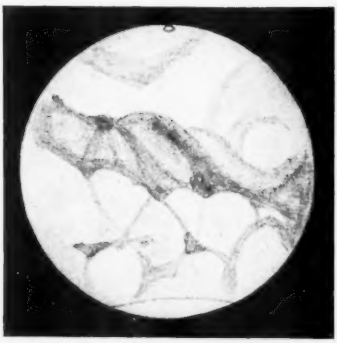

Fig. 18
Ellison 230° E

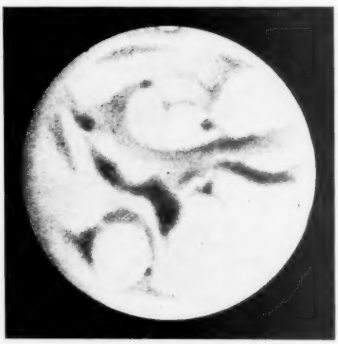

Fig. 21
Phillips 287° F

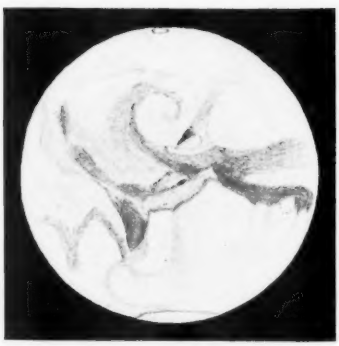

Fig. 22
Ellison 302° F

DRAWINGS OF MARS IN 1926.

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PLATE XV

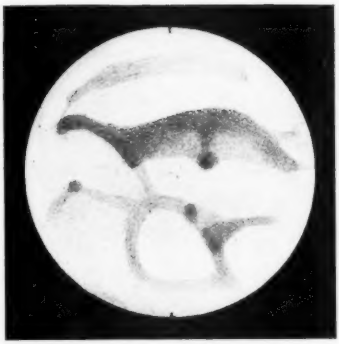

Fig. 15
Pickering 182° D

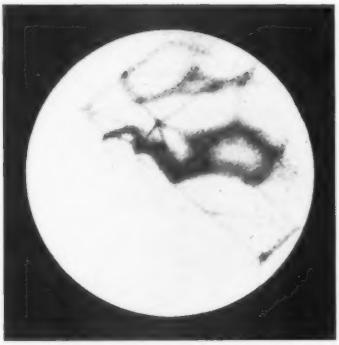

Fig. 16
Trumpler 162° D

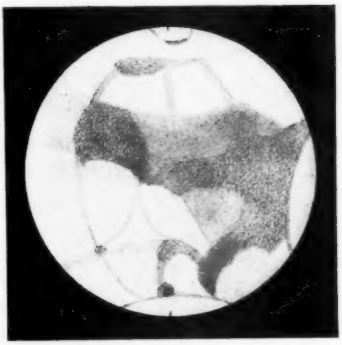

Fig. 19
Pickering 242° E

Fig. 20
Trumpler 233° E

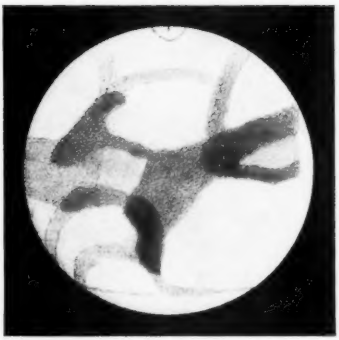

Fig. 23
Pickering 299° F

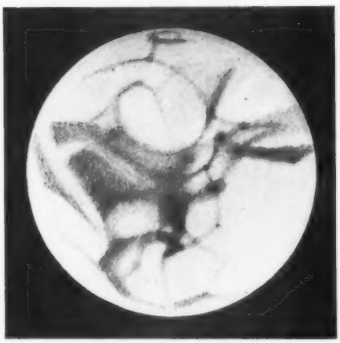

Fig. 24
Trumpler 290° F

DRAWINGS OF MARS IN 1926.

polar cap. In case the snow itself is visible, the number of pieces of glass should be so chosen that the paper shall match the snow cap. Yellow ochre is the best ground color, but orange or yellow must be added for the center. The region north of Sabaeus is markedly redder than other portions of the disk. Colored crayons are preferable to water colors. Colored sketches should never be sent for publication.

Martian clouds are usually yellow to yellowish white, on account of the dense atmosphere through which they are seen, and when they are near the center of the disk they are sometimes hardly distinguishable in color from the snow itself. On the other hand when superposed on the deserts, which is their usual location, and along the limb, it is often impossible to distinguish them from the deserts themselves. This causes one of the chief difficulties in the study of the surface changes on Mars. Therefore when the clouds are occasionally projected on the dark areas of vegetation, especial attention should be directed to their changing shapes and location, if these vary from night to night, in order to give us some idea of the direction and velocity of the winds on Mars. When the terminator is brighter than the center this indicates cloud. It appears that clouds are more readily detected by photography than by visual observation, but this requires an instrument driven by clockwork, in order to be successful.

Judged by our observations made at a similar season in 1913, light greens should begin to appear in the northern polar regions between ⊙ 300° and 330°, or in Martian January and early February, when the moisture reaches there from the southern pole. These northern polar greens are much lighter and more brilliant, though perhaps less conspicuous, than those of the southern maria, which also appears before the northern vernal equinox. These latter were seen first in Cimmerium and Sirenum and soon after to the south of Furca and Margaritifer. The difference in color of these two greens is like that existing between our grassy plains and the woods and bushes growing in other places. The northern polar greens are soon covered, however, by the polar snow cap, whose almost bluish whiteness and brilliancy is very striking. The difference in color between the snow and the whitish yellow clouds is usually appreciably more marked than that between the clouds and some of the yellow deserts. The difference in color between the northern and southern maria at this season is quite marked. The greens appear in both the autumn and springtime. The southern polar cap is now composed of yellow cloud, while the northern is pure white snow. Immediately north of the three great marshes which bound the northern cap snow soon turns light bluish. A dense haze covering the whole planet is sometimes seen, lasting for days or even weeks at a time.

Acidalium will soon turn bluish gray near the snow, and later the whole marsh will take on a very striking deep blue color. The greens of the maria soon become very pronounced. The two dark marshes, Boreosyrtis and Propontis, presently begin to turn blue, but never as

markedly so as Acidalium. Cerberus, which is in latitude just to the north of the equator, remains brown. In 1913 and 1915 Propontis was widely and obviously doubled and lengthened, its southern end moving slowly towards the west, thus changing its position angle on the planet. See Report No. 4. After ⊙ 10°, Martian Date March 21, the greens of the maria were thought to be less marked, possibly due to haze. By ⊙ 17°, Sabaeus had turned to a clear chocolate brown, of the color of freshly upturned soil. Clouds were seen rising from, and following the three northern marshes. Euxinus was a dark gray, neither green nor brown. The maria preceding and following it were greenish, but not markedly so. By ⊙ 20°.4 the greens of the maria were again strongly marked. At ⊙ 22°.7 March 47, Euxinus turned a conspicuous dark blue, and changed the location of its preceding border. The changes in color and extent of this marking are at certain seasons quite frequent, although the blue is of short duration, and should be watched for at all stations and carefully drawn, since the cause is unknown, although believed to be due like the greens to vegetation. A change of boundary towards the south is also sometimes quite rapid. The canal Thoth was recorded as brownish.

At ⊙ 29°.6, M. D. April 6, Lunae was also brown, the southern pole was recorded as dark greenish gray, and darker than the terminator, which was darker than the center of the disk. White clouds were recorded, which were not at all yellow. By ⊙ 32°.8 the maria had turned light green and the torrid regions were covered by a light general shading. A few days later the greens were no longer conspicuous. Broad faint bands crossed the northern deserts. The dark boundary to the melting snow had partly disappeared. At ⊙ 34°.6, Sabaeus was still a clear brown, Acidalium blue, followed by a conspicuous cloud, there was no pronounced green, and the south pole was very dark. Four days later Euxinus had vanished, and the Syrtis had at last turned green, M. D. April 20. Since the Syrtis is in the northern torrid zone, this was its spring. On M. D. April 38, Cerberus was still brown and Propontis had vanished. The last record was made on Martian Date May 43, diameter of the planet 5″.9. The maria were still recorded as green, but on account of the planet's distance the record is somewhat uncertain. At the next apparition in 1915, ⊙ 12°.0, M. D. March 25, the Acidalium marsh showed clear evidences of polarization, indicating thereby a free liquid surface, doubtless water. This only shows at rare intervals, presumably when the marsh is sufficiently full of water.

PRIVATE OBSERVATORY, MANDEVILLE, JAMAICA, B. W. I., JULY 20, 1928.

REPORT ON NIUAFOU ISLAND AS STATION FOR SOLAR ECLIPSE OBSERVATION.

By ANDREW THOMSON.

The island of Niuafou (175° 41′ W, 15° 35′ S) is the only land area in the path of totality of the solar eclipse of October 22, 1930, with the exception of Nurakita (179° 30′ E, 10° 45′ S), a small island in the Ellice Group. The latter has numerous disadvantages; it is about one square mile in area, low, flat, thickly wooded, and exceedingly difficult of access. Totality commences at Nurakita at $20^h\ 36^m.9$ G.M.T. ($8^h\ 35^m$ local time), and lasts 55 seconds, the Sun's altitude being 43°.

The center of the Moon's shadow passes about 8 miles distant from the N.E. extremity of Niuafou at $20^h\ 51^m.6$ approx. $9^h\ 9^m$ local time. The duration of totality is 83 seconds and the Sun's altitude 52°.

Niuafou is situated about midway between the three groups—Samoa, Tonga and Fiji. Although 300 miles east of the 180th mer., Eastern Time is kept in conformity with other islands of the Tongan Group. The following is a table of distances in statute miles from Niuafou:

Apia, 280. Auckland, 1500. San Francisco, 4300. Suva, 425.
Sydney, 2500. London, 9800.

Niuafou belongs to the principality of Tonga, the sole self-governing state in the South Pacific. Communication with Niuafou from the outside world is difficult and infrequent. The monthly interisland steamer drops the mail overboard in a soldered tin can in deep water a few hundred yards off shore. Two natives swim out and push or drag the mail box ashore—whence the local name of Niuafou—tin can island.

The Apia agent of the Union Steamship Company ventured it as his opinion that the Union Company would allow their monthly boat to stop for a few hours to disembark a responsible party. The General-Manager of the Union Steamship Company, at the Head Office, Wellington, New Zealand, should be addressed for any such request. Should circumstances be such that the company could not accede to a request to land a party, a small boat could be chartered at either Suva, Fiji, or Apia, Samoa, but the cost would be fairly high.

The Department of External Affairs of New Zealand have recently had a small vessel built in England for the fruit trade between the South Sea islands under her administration and New Zealand. The vessel has not yet left the shipyard so that it is too early to consider the possibility of travelling by this means. A small steamer making visits at irregular intervals comes from Tonga to supply the trading stations. Tonga is itself off the regular ocean routes whereas Apia or Suva have a more frequent boat service. The time taken to reach either port is

about thirty-three days from London, and fifteen days from either Vancouver (Canadian Australasian line) or San Francisco (Matson Oceanic line).

Mr. C. S. Ramsay, a trader on the island, has sent the following statement about getting instruments ashore: "Should the northern landing (Agaha) be unfavorable, the western side (Futu) will be workable unless a westerly wind be blowing. This latter contingency is not to be expected and even should it so happen, the westerly will not last. No fears need be entertained re the discharge of equipment as long as it is in cases of medium size and weight or otherwise wrapped or protected."

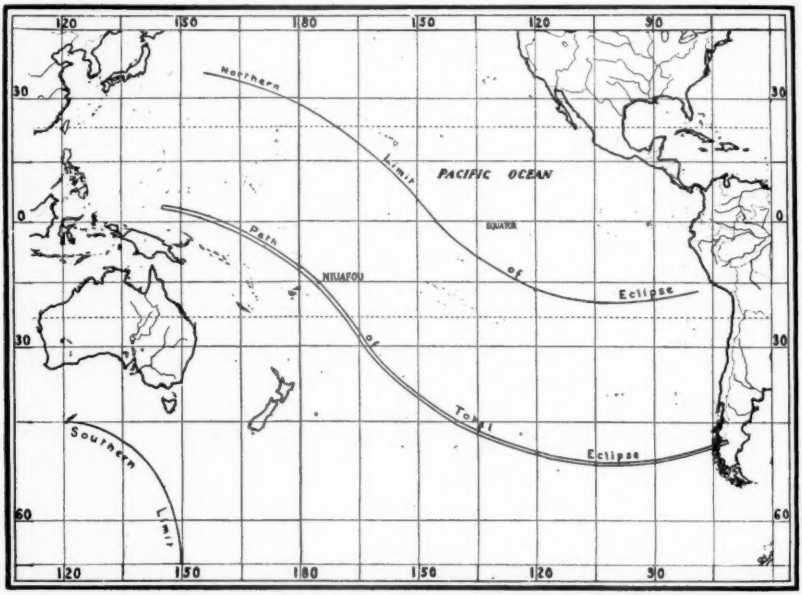

FIGURE 1.

Mr. Westland, Assistant Director of the Observatory, has written the following statement about landing facilities: "When I passed Niuafou Island in August, 1926, the sea was exceptionally smooth, and the captain of the *Tofua* took his ship in very close to the island to interest the passengers. There was a small vessel anchored very close to the shore, so close that I surmise her anchor was resting on a ledge of rock, projecting from the perpendicular walls which form the outline of the island. At the foot of these rocks there was a low jetty for boats to go alongside of, and a wooden structure led down to it from the flat ground above. I could not see whether this was a stairway or a tram way for trucks. But it is evident that there would be no difficulty in

landing heavy cases of instruments and cement from a small vessel which could use this anchorage."

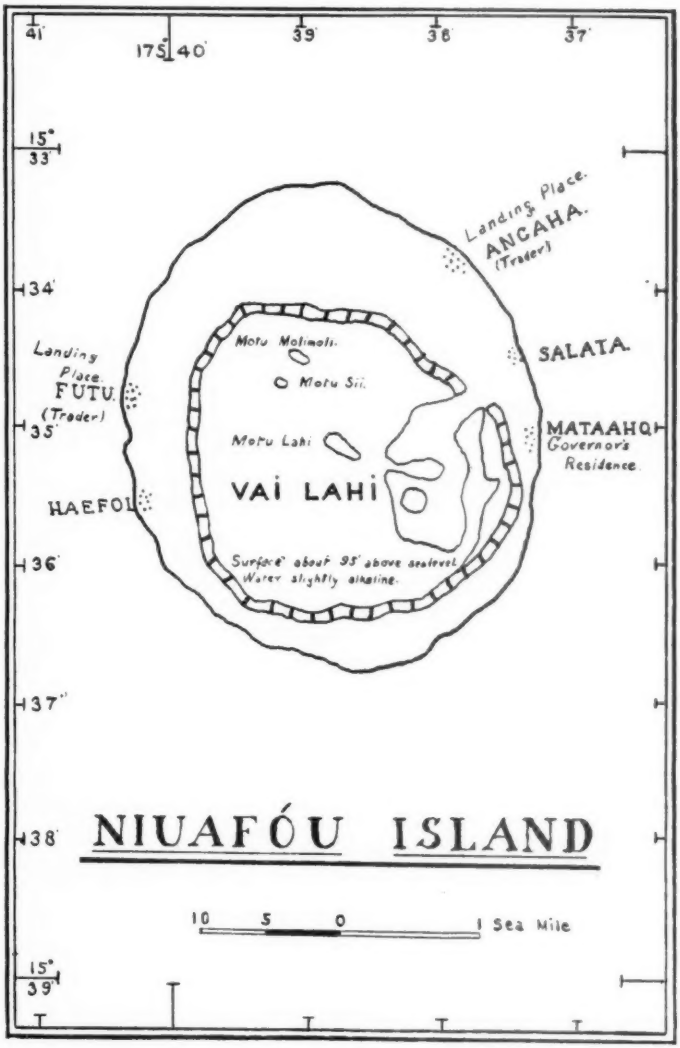

FIGURE 2.

Niuafou is shaped like a gigantic signet ring—three miles in diameter,, one-third mile thick with the thickened portion for the seal lying

towards the north. The island is purely volcanic and has been thrown up from ocean depths. It has no beach and is not protected as many South Sea islands are by a fringing coral reef. The rollers from the Pacific dash against precipitous basalt cliffs 30 to 70 feet high. From the top of these cliffs the land slopes gently upwards to heights 300 to 600 feet high. These slopes are thickly covered with palm trees and dense tropical verdure. On the other side the hills slope down to an inland lake about 2½ miles in diameter and 95 feet above sea level. The crater of the volcano erupted in 1886 forms a large peninsula on the west side of the lake and near the center three islets may be seen. The water has a pronounced mineral or spa like flavor; at one place called the "Boiling Water"; it is so charged with gas that the water bubbles vigorously. Some years ago a motor boat used to navigate the lake.

Almost the whole population of about 1100 belong to the Polynesian race. The natives are Tongan and speak that language although a few converse in English. The natives are highly spoken of for their hospitality. A Roman Catholic mission directed by a Father and a Sister have been on the island for many years. The traders keep a supply of the necessities of life—groceries, flour, tinned beef, salmon, etc., but a party would certainly find it advisable to bring a supply of food of their own.

Niuafou lies about the middle of the S.E. trade wind belt. Over the open ocean in the vicinity of the island the winds are E. or S.E. for 65 percent of the time during the quarter September-November.

No meteorological observations have been taken at Niuafou but it is probable that conditions will be similar to those at Apia, Samoa. Table I is a summary of 33 years' observations (1890-1924) at Apia of pressure, temperature, humidity, rainfall and 6 years for sunshine (1905, '06, '16-'19).

TABLE I.

METEOROLOGICAL OBSERVATIONS, APIA, SAMOA.

	Pressure inches	Temp. ° F.	Humidity %	Rainfall inches	Cloudiness 9 a.m.	Sunshine Hrs. per month
Jan.	29.764	79.01	85.3	16.81	5.5	146
Feb.	.778	79.00	85.4	15.71	5.4	123
March	.800	79.34	85.4	13.54	4.9	166
April	.822	78.91	85.4	10.24	4.9	159
May	.858	78.40	84.1	5.51	4.2	176
June	.874	77.80	83.0	5.16	4.3	157
July	.884	77.20	81.8	2.64	4.5	185
Aug.	.890	77.80	80.0	3.15	3.9	200
Sept.	.888	78.21	81.3	5.12	4.6	177
Oct.	.868	78.42	82.0	6.06	4.8	184
Nov.	.810	78.69	82.9	9.29	4.6	163
Dec.	.777	79.25	83.2	13.62	5.1	145
Annual	29.834	78.48	83.3	106.85	4.8	2038

The temperature variation throughout the day is very small; the hottest hour for October being 11 A.M. with a temperature of 84°.2 F,

and the coolest 5 A.M. with a temperature of 74°.7 F.

The duration of sunshine for October for the past five years is given in Table II.

TABLE II.

DURATION OF SUNSHINE IN OCTOBER, 1923, 1924, 1925, 1926, 1927.

Yr./Hr.	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	Total
1923	17.0	21.0	25.1	22.1	22.5	25.7	20.8	21.5	21.0	18.9	17.9	13.2	246.7
1924	10.3	17.4	18.9	21.9	21.4	20.3	19.0	18.1	18.8	17.8	15.9	9.3	209.1
1925	17.3	21.5	23.2	20.7	21.8	20.8	19.0	19.5	16.8	16.5	15.0	9.4	221.5
1926	20.0	25.0	25.2	25.6	25.7	24.9	22.5	21.7	19.9	19.8	18.2	12.2	260.7
1927	7.6	18.6	21.5	23.7	23.9	21.2	20.5	18.9	15.5	17.6	16.1	8.6	213.7
	14.4	20.7	22.8	22.8	23.1	22.6	20.4	19.9	18.4	18.1	16.6	10.5	230.3

The atmosphere is fairly clear with moderately good visibility. The outline of the mountains on Savaii approximately 50 miles away can be seen four days out of five. Occasionally the light and dark areas on the mountain side can be picked out. This occurs most frequently after a rain when the foreign matter probably salt crystals are washed out of the air.

Ten o'clock in the morning has been found by long experience at Apia to be the time of day when pilot balloons may be released with the best chance for observing a long flight. The eclipse requires for its successful observation the same cloudless conditions, so that it is a matter of good fortune it occurs at the most favorable hour of the day.

HISTORICAL: According to the *Pacific Islands Pilot,* Vol. II, published by the British Hydrographic Office, Niuafou was discovered by Captain Edwards in H.M.S. *Pandora,* 3rd August, 1791, and named by him Proby Island. It has been the scene of many volcanic eruptions. A serious outbreak occurred in 1853 when a village was destroyed and many lives were lost. On the south side of the island another outbreak took place on April 12, 1867. Again in 1886 an eruption destroyed many cocoanut trees and food plantations. The last period of activity was in 1912 when lava flowed down into the sea near the village of Futu on the western side of the island.

NOTES: The island is noted for being the home of the melau or megapode (*melau pritchardii*), a bird rather smaller than the pigeon which lays an egg disproportionately large compared with itself. The eggs are laid carelessly and are hatched out without being sat on by the parent birds.

The largest cocoanuts grown in the Pacific are produced on Niuafou. Many years ago shiploads of nuts were exported to Samoa for growing on plantations in the hope of increasing the size of the Samoan cocoanuts. It was found, however, that the palm trees grown from the Niuafou seed did not produce large nuts, being indistinguishable in size from the ordinary Samoan cocoanuts. This would indicate the large size of the Niuafou cocoanuts was due either to thermal effects or some element in the volcanic soil.

APIA, SAMOA, JANUARY 3, 1928.

W. HERSCHEL'S DIFFUSED NEBULOSITIES.[1]

By W. S. FRANKS.

Having been urged by Father Hagen to undertake some visual observations of these long neglected and much disputed nebulous regions, which were observed casually by Sir W. Herschel in the intervals of more definite observing work, and published by him as objects requiring further attention—I felt constrained to make the attempt, though perhaps ill equipped for such an undertaking. The telescope used was the 6⅛-inch Cooke equatorial of Brockhurst Observatory; with a specially made Kellner eyepiece, giving a field of 36′, with a power of 80 diameters. The O.G. is rather a shorter focus (82 in.) than usual and equivalent to F/13.4. Preliminary experiments were made with various eyepieces, including some very fine "orthoscopic"; but though they gave splendid definition, their fields of view were too small to afford the desired amount of sky contrast. So Messrs. Cooke made the new Kellner eyepiece to our specification, and it answers its purpose admirably.

Knowing that only the very clearest skies were suitable for this kind of work, no attempt was made to observe these extremely faint and elusive objects except in the total absence of moonlight or twilight, and when the Milky Way appeared conspicuously bright to the naked eye. I give the observations for what they are worth; considering the relatively small aperture of the telescope. But Tempel's nebula in the Pleiades was seen in some small instruments, when larger ones failed to show it! The fainter objects in Herschel's list I could not see at all; but anything rated as IV or V on Father Hagen's scale I could usually reach with more or less certainty. I may say that, after reading the circles, the eye was kept in total darkness for a few minutes before looking through the eyepiece; which I found was of great importance. And in the larger nebulosities the method of sweeping in R.A. was generally resorted to, in order to gain sufficient sky contrast. I am fully convinced now that Herschel was *not* mistaken in these objects, though he might profitably have paid more especial attention to them; and I feel equally certain that Father Hagen and his assistant saw what they described. I did not pretend to assign any boundary to these feeble nebulosities; as, owing to their indefinite character, all I could do was to satisfy myself of their real existence. I may add that I found the guiding stars, as given by Father Hagen, a great help in the correct identification of the nebulous fields.

Herschel's No.	Date of Obs.	Description and Remarks
1	31 Oct. 1927	Pretty extensive neby., especially *n* & *s*; fairly evident.
"	25 Nov. "	Neby. stretching across field to *s* edge; pretty certain.
"	13 Jan. 1928	Irregular extensive nebulosity.

[1] A list of these nebulosities may be found in *Astroph. J.*, **17**, 72. 1903.

Herschel's No.	Date of Obs.	Description and Remarks
2	31 Oct. 1927	Irregular patch of feeble nebulosity.
"	25 Nov. "	General milkiness around feeble patch.
"	13 Jan. 1928	Nebulosity about centre of field.
3	31 Oct. 1927	Suspected patches of faint nebulosity.
"	13 Jan. 1928	Faint patchy nebulosity.
"	25 Nov. "	Patchy feeble nebulosity.
4	31 Oct. 1927	Straggling patches of feeble nebulosity.
"	25 Nov. "	Diffuse nebulosity *s* of guiding star.
"	13 Jan. 1928	Faint diffuse nebulosity to the *s* of guiding star.
5	31 Oct. 1927	Rather feeble nebulosity to *sp* of guiding star.
"	25 Nov. "	General milkiness in field.
"	13 Jan. 1928	Rather milky field.
6	31 Oct. 1927	Patches of very faint nebulosity.
"	25 Nov. "	Rather feeble nebulosity.
"	13 Jan. 1928	General milkiness in field.
7	.....	Not seen on any of the dates as above.
8	31 Oct. 1927	Some faint extensive nebulosity in this region.
"	25 Nov. "	Streaky nebulosity certain.
"	13 Jan. 1928	Extensive and irregular nebulosity.
9, 10	.....	Not seen on any of the dates as above.
11	25 Nov. 1927	Diffuse nebulosity.
"	13 Jan. 1928	Faint diffuse nebulosity.
"	17 " "	Faint and diffuse nebulosity.
12	13 Jan. 1928	Faint nebulosity near centre of field; extensive.
"	17 " "	Nebulous patch about $\frac{1}{2}°$ *n* of guiding star; rather large.
"	22 " "	Certainly large nebulous patch to *n* of guiding star.
13	13 Jan. 1928	Faint nebulosity, somewhat similar to last, but smaller.
"	17 " "	Distinct nebulous patch $\frac{1}{4}°$ *sf* guiding star.
"	22 " "	Nebulous patch to *sf* of guiding star.
14, 15	17 Jan. 1928	(Observed together as one field). Certainly some nebulosity near guiding star.
"	22 " "	Distinct nebulosity *nf* guiding star, with fainter extension towards star.
"	13 Feb. "	Certainly neby. extending from guiding star towards *nf*.
16	22 Jan. 1928	Some rather feeble and irregular nebulosity here.
"	13 Feb. "	Some feeble nebulosity in this area.
"	16 " "	Faint and irregular nebulosity.
17	22 Jan. 1928	Faint nebulous patch, rather irregular.
"	13 Feb. "	Faint patch of nebulosity.
"	16 " "	Faint nebulous patch, plainest to *sp*.
18	22 Jan. 1928	Feeble and rather patchy nebulosity.
"	13 Feb. "	Very feeble and patchy nebulosity.
"	16 " "	General milkiness, rather stronger to *sp*.
19	22 Jan. 1928	Suspected patches of feeble nebulosity.
"	13 Feb. "	Some very feeble patches suspected.
"	16 " "	Very faint nebulosity; scarcely suspected.
20, 21	13 Feb. 1928	(Observed together). Some extended and feeble neby. here.
"	16 " "	Extended faint neby. to *n* of guiding star.
"	17 " "	Feeble and extended nebulosity.
22	13 Feb. 1928	Diffuse nebulosity; ι Orionis distinctly involved in neby.
"	16 " "	Diffuse neby. pretty certain; ι Orionis clearly involved in nebulosity and sky around cl. *sp* very dark.
"	17 " "	Diffuse nebulosity, plainest to *sf*.
23	13 Feb. 1928	Diffuse nebulosity; guiding star is Σ 731.
"	16 " "	Diffuse and rather patchy nebulosity.
"	17 " "	Patchy and uneven faint nebulosity.

Herschel's No.	Date of Obs.	Description and Remarks
24	13 Feb. 1928	Not certainly seen, but patches suspected.
"	16 " "	Not seen at all, or barely suspected.
"	17 " "	Strong suspicion of patchy nebulosity, mostly towards *f*.
25	13 Feb. 1928	Irregular nebulosity certainly seen here.
"	16 " "	Faint nebulosity certain around darker space.
"	17 " "	Marginal nebulosity around dark space pretty certain.
26	13 Feb. 1928	Pretty certain nebulosity, especially towards *sp*.
"	16 " "	Nebulosity fairly certain towards *sp*.
"	17 " "	Nebulosity certainly visible, brightest to *s*.
27	13 Feb. 1928	Irregular feeble nebulosity.
"	16 " "	Certainly some irregular and extended nebulosity.
"	17 " "	Some streaky and extended nebulosity here.
28	13 Feb. 1928	Some feeble patches of nebulosity.
"	16 " "	Faint and patchy nebulosity.
"	17 " "	Some patches of faint nebulosity in this area.
29	.....	Not seen on any of preceding dates.
30	13 Feb. 1928	Cluster obvious; but no nebulosity seen in *p* area. Nor on 16 February and 17 February.
31	.....	Not seen March 9, 10, 15, 1928.
32	13 Feb. 1928	Not very sure, but thought background rather patchy?
"	16 " "	Feeble and patchy nebulosity strongly suspected.
"	17 " "	Somewhat patchy nebulosity, chiefly towards *np*.
33	9 Mar. 1928	Nebulosity pretty certain to *sp* and around guiding star.
"	10 " "	Faint nebulosity *sp* guiding star.
"	15 " "	Feeble nebulosity around guiding star and twrds *s* of field.
34	9 Mar. 1928	Some faint and uneven nebulosity, plainest towards *n*.
"	10 " "	Faint and patchy nebulosity, brightest to the *n*.
"	15 " "	Uneven and faint, strongest towards *n*.
35	9 Mar. 1928	Very similar to last, strongest towards *n*.
"	10 " "	Irregular and patchy nebulosity, plainest to *nf*.
"	15 " "	Faint and uneven, best towards *nf*.
36	9 Mar. 1928	Diffuse milkiness in field.
"	10 " "	Feeble nebulosity or milkiness over field.
"	15 " "	Faint milkiness over field.
37	10 Mar. 1928	Some faint and diffuse nebulosity in this field.
"	15 " "	Feeble and indefinite nebulosity suspected.
"	16 " "	Some milkiness suspected, but very indefinite.
38	10 Mar. 1928	Diffuse nebulosity seen from contrast with dark gap.
"	15 " "	Faint and diffuse nebulosity near darker patch.
"	16 " "	Fairly sure of this, by contrast with dark gap.
39	10 Mar. 1928	Certainly some nebulosity in this area.
"	15 " "	Pretty certain of diffuse nebulosity here.
"	16 " "	Certain nebulosity, though very diffuse.
40	10 Mar. 1928	Some very feeble and irregular patches of nebulosity.
"	15 " "	Irregular patches of faint nebulosity suspected.
"	16 " "	Appeared to be irregular patches of nebulosity.
41	10 Mar. 1928	Nothing seen here.
"	15 " "	No nebulosity even suspected.
"	16 " "	Nothing seen in this area.
{ 42a	27, 31 Aug.	Nothing seen here, under best atmospheric conditions.
{ 42b	22 Oct. 1927	
43	28, 31 Aug. 22 Oct. 1927	Good field of stars, but no suspicion of nebulosity.
44	28 Aug. 1927	Seemed some patchy nebulosity around darker space.
"	31 " "	Sky here looked darker by contrast with border.
"	22 Oct. "	Dark space, with suspicion of marginal nebulosity.

Herschel's No.	Date of Obs.	Description and Remarks
45	28 Aug. 1927	Certainly a kind of nebulous cloud seen by sweeping.
"	31 " "	Seems to be some feeble nebulosity in this area.
"	22 Oct. "	Faint diffuse nebulosity about $\frac{1}{4}^{\circ}$ *s* of the guiding star.
46	28 Aug. 1927	Pretty certain of irregular streak across field.
"	31 " "	Faint streak of nebulosity crossing field diagonally.
"	24 Oct. "	Feeble band of nebulosity across field *sp* to *nf*.
47	22 Sept. 1927	Diffuse nebulosity about centre of field.
"	24 " "	Some patchy nebulosity seen when sweeping.
"	24 Oct. "	Feeble patchy nebulosity near centre of field.
48	22 Sept. 1927	Not much doubt about the nebulosity here.
"	24 " "	Certainly diffuse nebulosity in this area.
"	24 Oct. "	Diffused nebulosity pretty certain.
49	22 Sept. 1927	Undoubted nebulosity, more pronounced than last.
"	24 " "	Even stronger than 48; no doubt about these two.
"	24 Oct. "	Certain nebulosity here, rather stronger than last.
50, 51	22 Sept. 1927	(Obs. together as one field). Feeble patchy nebulosity.
"	24 " "	Certainly some nebulosity here, best seen by sweeping.
"	31 Oct. "	Nebulosity *n* and *s* pretty evident; feebler *p* and *f*.
52	22 Sept. 1927	Some nebulosity here, only caught by sweeping.
"	24 " "	Rather feeble nebulosity, best seen when sweeping.
"	31 Oct. "	Feeble and extended, when sweeping to get contrast.

A NEW ASTRONOMICAL OBSERVATORY.

By ROLAND W. SELLEW.*

The new astronomical observatory recently completed for the University of South Carolina at Columbia, S. C., presents some new and unique features in this class of work. The great majority of observatory buildings, no matter how admirably they may be suited to the needs of the astronomer, unfortunately are anything but pleasing structures architecturally. Possibly this fact may be due to a lack of understanding of the requirements between the engineer designing the observatory dome proper and other mechanical features, and the architect charged with the design of the building. Probably, however, it is more often due to a lack of any intelligent design efforts towards appearance.

While the necessary hemispherical shape of the dome does not lend itself readily to a harmonious architectural design except in large and imposing structures, still it is possible, with proper study, to produce a pleasing appearance. The new building for the University of South Carolina, a reproduction of which is herewith shown, is one of the few of its sort which will enhance rather than be detrimental to its surroundings.

Due to the proximity of trees and other buildings to the site of the new observatory it was necessary to place the floor supporting the

*Designer of the mechanical features of the observatory.

telescope well above the ground in order that an unobstructed view might be obtained in all directions within a few degrees of the horizon. Coupled with this limitation was the economic necessity of keeping the supporting portion of the structure to a moderate size. From these conditions it might seem that the appearance would be more like that of a useful but decidedly unbeautiful silo with a round top than anything else. However, the architect for the building, working in harmony with the utilitarian demands of the engineer, was able to produce, in spite of the limitations imposed, a model which will undoubtedly be copied by other universities contemplating new observatories.

The construction of the dome itself, while not unlike many similar structures, has several interesting features. This portion is truly hemispherical in shape with a sliding portion or shutter which can be moved to one side, thus uncovering a slit several feet in width extending from the bottom edge, or horizon level, to a point somewhat beyond the top center, or zenith. The entire dome may be rotated as far as desired in either direction thus bringing into direct vision through the slit any portion of the heavens. Since no stationary or firm support can be utilized as a base from which to secure permanently the frame of the dome, due to the necessity of turning it, and since the dome must be

nearly cut in two by the slit opening, it is imperative that a steel frame work be used. Many domes have in the past been built with wood frames, that is in the smaller sizes, but all of them are quite unsatisfactory, although they do have the advantage of being light and easily turned. The frame in the present instance consists of a lower ring, built up from light steel sections and trussed so as to be substantially rigid. Upon this ring steel ribs, accurately bent to the correct radius and equally spaced about the circumference of the dome, are supported. The ribs at their upper ends are secured to the members forming the sides and top of the slit or shutter opening and all of the component parts are trussed and rigidly tied together. To the exterior surfaces of all steel members wood furring or nailing strips are bolted to which in turn wood sheathing is nailed. Over the sheathing copper sheet roofing is applied and all made weather tight in this way. All of this construction necessitates no small amount of weight and still the whole must be turned readily and without great effort. To accomplish this a standard railroad rail is used formed accurately to a circular shape and upon this cone shaped wheels roll which in turn support the dome. The cone shape of wheel is used so that they will follow the circular rail without slip or friction and the shafts upon which they are mounted turn in ball bearings. A dome recently built weighing nearly seven tons and mounted as above described was easily turned by a direct push, but in spite of this it is necessary to provide a mechanical turning means, either operated by hand, through a considerable gear reduction, or by an electric motor. Direct hand turning would be impractical in any but the smallest of domes since the clearances between moving and stationary parts, necessary to make the work weather tight, quite frequently, in northern climates, become frozen tight with ice and sleet storms and a considerable force is needed to free them. The South Carolina dome will be turned by a hand wheel about two feet in diameter operating through a moderate gear reduction.

The shutter operating mechanism is also to be hand operated from a similar wheel. The weight involved for this part is very slight and consequently a low gear reduction is used. A system of light steel cable and idler pulleys is used for the shutter mechanism so arranged as to insure that the top and bottom of the shutter will move simultaneously and evenly, otherwise it would bind.

The cut accompanying this article illustrates the various features of the dome and the building. The instrument which will be set up in the observatory is a 15-inch reflector and when all is ready for use the University of South Carolina will be admirably equipped for instruction in astronomy.

13 CETI AS A VARIABLE STAR.

By ALEXANDER POGO.

According to a preliminary announcement by P. Slavenas,[1] 13 Ceti (1900: $\alpha = 0^h\ 30^m.1$, $\delta = -4^\circ\ 9'$) is a variable star, with an amplitude of nearly $0^m.2$, and a period of $0^d.4692$; the epoch of maximum, as indicated by his data, is J. D. 2425186.808 G.M.T.

The spectroscopic period of the brighter component A of the visual binary 13 Ceti AB is $2^d.08186$, which is not a multiple of the preliminary photometric period. For the sake of comparison, we add that there was a maximum velocity of recession of the brighter component A′ of the spectroscopic binary 13 Ceti A′A″ on J. D. 2425186.091 G.M.T., that is, $0^d.339$ before an epoch of maximum light.

If we accept the preliminary photometric elements of Slavenas as corresponding, within certain limits, to a physical reality, either one of the two components of the visual binary 13 Ceti AB can be responsible for the variation of the total light received from that close pair (maximum separation about 0″.3).

The 5.6-magnitude spectroscopic binary A consists of two unequally bright dwarf stars, a few million kilometers apart. If they form an eclipsing binary, the spectroscopic and the photometric periods should coincide. The period indicated by Slavenas may, conceivably, correspond to the period of rotation of the bright star A′. The spectrographic study of 13 Ceti has revealed the possibility of periodic changes in the atmosphere of A′ (or of both spectroscopic components), which are as yet little understood, and may be connected with photometrically observed variations.

The 6.4-magnitude visual companion B has been suspected by M. Maggini,[2] who made an interferometric study of the system 13 Ceti, of being in slow orbital motion with an invisible satellite. On the other hand, a spectrographic investigation of the system by the writer[3] seems to justify the hypothesis that the visual companion B may be a short-period binary, B′ B″. The period found by Slavenas corresponds, conceivably, to a rotation or to eclipses of B, or to its pulsations.

To decide, which one of the two components, A or B, of the visual system is responsible for the periodic variations of their integrated light, the following considerations could be used. During the coming two seasons of observation, the spectroscopic binary A will be about 3 astronomical units "behind" the plane of the sky passing through the center of mass of the visual system. During the same oppositions of

[1] *Astronomische Nachrichten*, **233**, 125, 1928.
[2] *Astronomische Nachrichten*, **233**, 97, 1928.
[3] *Astrophysical Journal*, **68**, 1928.

1928-29 and 1929-30, the visual companion B will be about 3 astronomical units "in front" of the central tangent plane. Around 1932.6, the two stars will be at the same distance from us, A emerging from the central plane of the sky, and B receding through it. At the epoch of the next periastron passage, around 1932.8, the spectroscopic binary A will be almost one hundred million miles closer to us than the visual companion B.

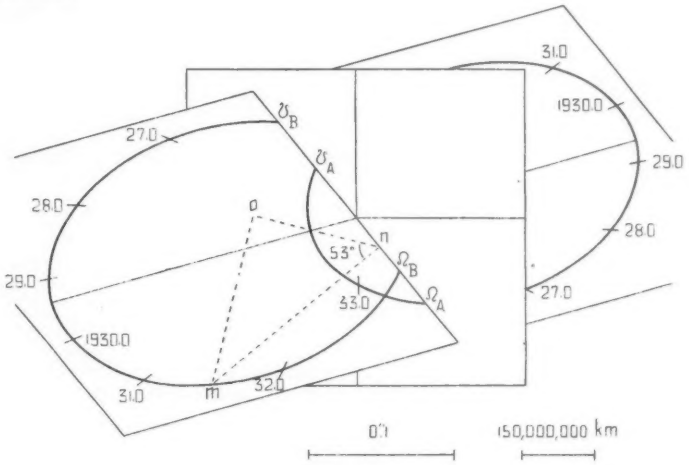

FIGURE 1.

True absolute orbits of 13 Ceti A (right) and of 13 Ceti B (left). The plane of the orbits is represented after a rotation through 53° around the line of nodes. The point m of the inclined orbit is chosen in such a way that it is 20 minutes of light "in front" of the plane of the sky through the center of mass of the visual system, the distance $mo = 0.8\ mn$ corresponding to about 220 million miles.

The radial velocity of recession of the system 13 Ceti AB is close to 8 km/sec; at that rate, the distance of its center of mass increases by 14 minutes of light per year. Figure 2 shows that, in 1931 and 1932, the recession of the system roughly compensates for the orbital motion of approach of A; in 1933 and 1934, the orbital motion of approach of B is practically compensated by the recession, in the line of sight, of the center of mass of the visual system.

If the photometric period should be confirmed, and if it should remain the same, when determined independently at each opposition, then the following theoretical considerations might, possibly, lead to the identification of the variable component of the visual system.

The difference between the apparent period P_a and the true period P_t (corresponding to a star at constant distance) is but a small fraction of the true period, according to the formula connecting them with the radial velocity γ of the variable star,

$$P_s = P_t\,(1 + \gamma/300{,}000).$$

Taking +8 km/sec as the mean value[5] of γ of either component, we see that the accumulation of this difference during one year (about 780 periods) makes up two hundredths of the length of the period.

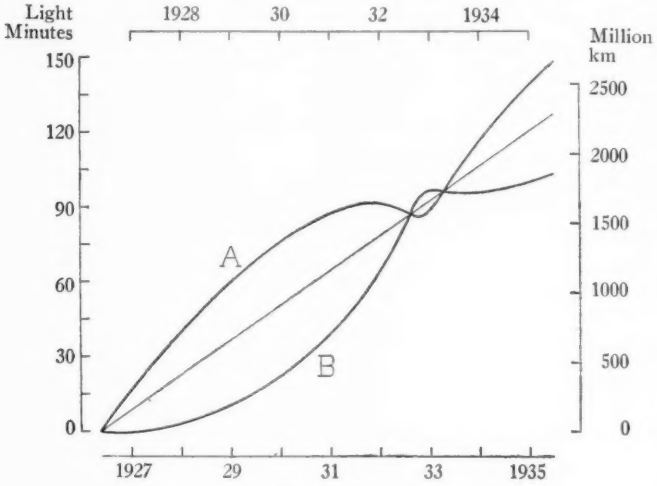

FIGURE 2.

Curves of recession, in the line of sight, of 13 Ceti A and 13 Ceti B.[4] The nodes of 1926.4 are chosen as the origin of epochs and distances. With the adopted parallax of 0″.05, the system is 65 light-years away.

Though the first four decimals of the periods determined in 1932 and 1934 may be identical, it should, theoretically, be possible to tell, which one is the true period. If an ephemeris is computed with an initial epoch in 1932, the observations of 1934—the heliocentric reduction being, of course, applied, as in the case of other variable stars—should show a systematic shift of phase, either to the "right" or to the "left," amounting to a few hundredths of the length of the period. If the observations are "too late," the extrapolation was made with the shorter period P_t, that is from the "horizontal" branch of Figure 2 into the ascending branch; the spectroscopic star A is then responsible for the photometric

[4] Since the rate of change of the radial distance, if plotted against the time, would give the theoretical long-period radial-velocity curves of 13 Ceti A and 13 Ceti B, the curves of Figure 2 could be obtained by the integration of such curves. They were, however, derived graphically from the orbits represented in Figure 1.

Referred to the axis of the center of mass, the curves of Figure 2 represent the astrocentric light-equations of the visual components A and B of the system.

[5] Spectrographic observations show that the γ-values of 13 Ceti A do not follow the theoretical long-period radial-velocity curve. Nothing is known about the behavior of the γ-values of 13 Ceti B. The mean of these values must be close to +8 km/sec.

variations. If, on the other hand, the observations of 1934 are systematically "ahead" of the ephemeris, it was computed with the longer period P_a, that is from the ascending branch of Figure 2 into the "horizontal"; the variable star is then the companion B.

Again, if A is the variable star, the observed light-curve of 1932 will, possibly, be shifted to the "left" of the extrapolated light-curve of 1929, by an amount sufficient for the purposes of identification. If B is the variable star, and if the observations of 1928 should confirm the period of 1927, the observed light-curve of 1931 or 1932 may show a measurable shift to the "right." If these preliminary tests should not succeed, the sharp bend of the curves of recession, corresponding to the critical epoch 1932-33, may give better results, if the observations of 1934 are compared with the extrapolated ephemeris of 1932.[6]

If, in spite of the apparent discrepancies between the spectrographically and micrometrically observed motions of A and B, the photometric observations of the system should enable us to establish the astrocentric light-equation of one of its members, we will have, incidentally, a check on our values of the linear dimensions of the true orbits, the parallax of the system, and the mass-ratio and luminosity of the components of the visual binary 13 Ceti AB.

We wish to emphasize the importance of systematic observations of the brightness of 13 Ceti by photographic and photoelectric methods.

YERKES OBSERVATORY, 1928 SEPTEMBER 3.

PLANET NOTES FOR NOVEMBER.

By CLIFFORD E. SMITH.

The *Sun* will continue to move southeast from the western part of Libra to the north central part of Scorpio about five degrees north of Antares. On November 12 there will be a partial eclipse of the sun which will be invisible in North America. The position of the sun on November 1 and on November 30 will be respectively, R.A. $14^h\,24^m$, Decl. $-14°\,17'$; and R.A. $16^h\,23^m$, Decl. $-21°\,35'$.

The phases of the *Moon* will occur as follows:

Last Quarter	Nov.	4 at	8 A.M.	C.S.T.
New Moon		12 "	4 A.M.	"
First Quarter		20 "	8 A.M.	"
Full Moon		27 "	3 A.M.	"

The moon will be at apogee on November 14 and at perigee on November 27. On November 27 there will be a total eclipse of the moon. According to the *American Ephemeris* the beginning will be visible generally in the western and

[6] Generalizing the above reasoning, and applying it to variable stars with well established "jumps" in epochs or periods, a sketch of the curve of radial distance might give us, in certain cases, an idea of the radial velocity of the system to which such a variable star might belong, and of the shape and the orientation of its orbit, in addition to the approximate epochs of its periastron passages.

northern borders of Europe, the Atlantic Ocean, North America, South America, the Pacific Ocean, and the northern part of Asia.

Mercury will be moving southeast from the eastern part of Virgo, near Spica, to the eastern part of Libra. On November 9 it will be at greatest elongation west and on November 10 it will be in conjunction with the moon. On the latter date it will rise about an hour before the sun.

Venus will be moving southeast from the western edge of Ophiuchus to the central part of Sagittarius. On November 7 Venus will be in conjunction with Saturn. On November 10 Venus will pass through aphelion, and on November 15 it will be in conjunction with the moon. On this last date Venus will set about two and one-half hours after the sun.

Mars will be in the western part of Gemini. It will be in conjunction with the moon twice during the month, once on November 2 and again on November 14. The apparent motion of Mars will be direct until November 12 when it will pass the stationary point, and thereafter it will move in retrograde motion. During the middle of the month Mars will be on the meridian about 4:45 A.M. Standard Time.

Jupiter will be in the southern part of Aries and its apparent motion will be retrograde during the month. On November 25 Jupiter will be in conjunction with the moon. At this time the moon will be about two days short of the full phase. During the middle of the month Jupiter will be on the meridian about 1:00 A.M. Standard Time.

Saturn will be in the southern part of Ophiuchus. On November 7 it will be in conjunction with Venus, and on November 14 it will be in conjunction with the moon. During the month the apparent position of Saturn will be close to that of the sun and it will not be in a position favorable to observation.

Uranus will be in Pisces during the month. On November 23 it will be in conjunction with the moon. Its apparent motion will be retrograde. During the middle of the month Uranus will be on the meridian about 10:30 P.M. Standard Time.

Neptune will be in Leo about five degrees west of Regulus. On November 5 it will be in conjunction with the moon. On November 23 it will be in quadrature west of the sun, and on that date it will be on the meridian about 6 A.M. Standard Time.

Occultations Visible at Washington.

[From the *American Ephemeris.*]

Date 1928	Star's Name	Magnitude	IMMERSION. Washington C.T.	IMMERSION. Angle from N	EMERSION. Washington C.T.	EMERSION. Angle from N	Duration
			h m	°	h m	°	h m
Nov. 2	39 Geminorum	6.2	5 54	80	7 4	298	1 10
2	40 Geminorum	6.3	6 16	109	7 28	270	1 12
4	57 B. Leonis	6.5	23 23	65	0 6	317	0 44
21	336 B. Aquarii	6.3	22 18	63	23 25	229	1 7
23	54 B. Ceti	6.3	1 52	21	2 33	284	0 42
26	145 B. Arietis	6.5	0 17	62	1 30	246	1 13
27	51 Tauri	5.6	5 55	56	6 42	287	0 47
27	56 Tauri	5.2	6 41	4	6 52	340	0 11
27	103 Tauri	5.5	22 25	32	23 21	288	0 56

VARIABLE STARS.

Minima of Variable Stars of Short Period.

[Calculated by members of the classes in Astronomy at Carleton College.]

Given to the nearest hour in Greenwich civil time; to obtain Eastern Standard time subtract 5^h; Central Standard time 6^h, etc.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of Minima in 1928							
					November							
	h m	° ′		d h	d h	d h	d h	d h	d h	d h	d h	d h
SY Androm.	0 08.0	+43 09	9.5—13.0	34 21.8	18 0							
RT Sculptor.	31.5	—26 13	9.6—10.5	0 12.3	3 3	10 6	17 10	24 14				
U Cephei	0 53.4	+81 20	7.0— 9.0	2 11.8	2 14	10 2	17 13	25 1				
Z Persei	2 33.7	+41 46	9.4—12	3 01.4	1 9	7 11	13 14	25 20				
TW Cassiop.	37.6	+65 19	8.2— 9.0	1 10.3	5 1	10 17	22 3	27 21				
RY Persei	39.0	+47 43	8.0—10.3	6 20.7	3 8	17 4	23 23	30 20				
RZ Cassiop.	39.9	+69 13	6.9— 8.1	1 04.7	4 8	13 22	23 11	28 6				
ST Persei	53.7	+38 47	8.5—10.5	2 15.6	5 15	13 13	21 12	29 11				
RX Cassiop.	2 58.8	+67 11	8.6— 9.1	32 07.6	7 3							
Algol	3 01.7	+40 34	2.3— 3.5	2 20.8	5 12	14 3	22 17					
RT Persei	16.7	+46 12	9.5—11.5	0 20.4	4 7	16 5	22 4	28 2				
λ Tauri	55.1	+12 12	3.3— 4.2	3 22.9	4 5	12 3	20 1	27 22				
RW Tauri	3 57.8	+27 51	7.1— [11	2 18.5	4 9	12 16	21 0	29 7				
RV Persei	4 04.2	+33 59	9.5—11.0	1 23.4	4 0	9 22	21 18	27 16				
RW Persei	13.3	+42 04	8.8—11.0	13 04.8	11 3	24 8						
SZ Tauri	31.4	+18 20	7.2— 7.7	3 03.6	4 16	10 23	23 14	29 21				
RS Cephei	4 48.6	+80 06	9.5—12.0	12 10.1	11 0	23 10						
TT Aurigae	5 02.8	+39 27	7.8— 8.7	0 16.0	1 17	12 19	18 7	29 9				
RY Aurigae	11.5	+38 13	10.7—11.7	2 17.5	3 9	14 6	19 17	30 15				
RZ Aurigae	42.9	+31 40	10.6—13.3	3 00.3	1 7	13 8	19 9	25 9				
SV Tauri	45.8	+28 05	9.4—11.0	2 04.0	1 22	8 10	21 10	27 22				
Z Orionis	50.2	+13 40	9.7—10.7	5 04.9	4 14	14 22	25 7	30 12				
SV Gemin.	54.6	+24 28	9.8— [11	4 00.2	2 8	10 9	18 9	26 9				
RW Gemin.	5 55.4	+23 08	9.5—11.0	2 20.8	4 18	16 5	21 23	27 16				
U Columbæ	6 11.2	—33 03	9.2—10.0	2 19.2	6 15	12 21	19 2	25 8				
SX Gemin.	22.0	+20 37	10.8—11.5	1 08.8	3 17	10 13	17 9	24 5				
RW Monoc.	29.3	+ 8 54	9.0—10.8	1 21.7	8 1	15 16	23 7	30 22				
RX Gemin.	43.6	+33 21	8.8— 9.6	12 05.0	1 2	13 7	25 12					
RU Monoc.	6 49.4	— 7 28	9.8—10.5	0 21.5	3 22	11 2	18 6	25 10				
R Can. Maj.	7 14.9	—16 12	5.8— 6.4	1 03.3	2 17	16 8	23 4	29 23				
RY Gemin.	21.7	+15 52	8.9— [10	9 07.2	7 20	17 4	26 11					
Y Camelop.	27.6	+76 17	9.5—12	3 07.3	1 13	8 4	21 10	28 0				
TX Gemin.	30.3	+17 08	10.0—11.9	2 19.2	7 6	11 16	24 1					
RR Puppis	43.5	—41 08	9.4—10.7	6 10.3	3 11	9 21	22 17	29 4				
V Puppis	7 55.4	—48 58	4.1— 4.8	1 10.9	1 4	15 17	22 23	30 6				
X Carinæ	8 29.1	—58 53	7.9— 8.7	0 13.0	5 19	12 20	19 21	26 22				
S Cancri	8 38.2	+19 24	8.2—10	9 11.6	5 17	15 4	24 16					
RX Hydræ	9 00.8	— 7 52	9.1—10.5	2 06.8	9 14	18 17	27 20					
S Velorum	29.4	—44 46	7.8— 9.3	5 22.4	2 18	14 15	20 13	26 12				
Y Leonis	9 31.1	+26 41	9.3—11.2	1 16.5	5 9	12 3	18 20	25 14				
RR Velorum	10 17.8	—41 36	10.0—10.9	1 20.5	6 17	14 3	21 13	28 23				
SS Carinæ	54.2	—61 23	12.2—12.8	3 07.2	7 11	14 1	20 16	27 6				
RW Urs. Maj.	10 35.4	+52 34	10.3—11.4	7 07.9	2 23	10 7	17 15	24 23				
Z Draconis	11 39.8	+72 49	9.9—13.6	1 08.6	1 5	14 19	21 14	28 9				
RZ Centauri	12 55.6	—64 05	8.5— 8.9	1 21.0	2 22	10 10	17 22	25 10				
RS Can. Ven.	13 06.3	+36 28	7.5—12.5	4 19.1	5 15	10 10	20 1	29 15				
SS Centauri	07.2	—63 37	8.8—10.4	2 11.5	1 7	8 17	16 4	23 14				
SX Hydræ	13 39.0	—26 23	8.6—12.7	2 21.5	3 13	15 3	20 22	26 17				

Minima of Variable Stars of Short Period—Continued.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of Minima in 1928							
					November							
	h m	° ′		d h	d h	d h	d h	d h				
δ Libræ	14 55.6	— 8 07	4.8— 6.2	2 07.9	3 22	10 21	17 21	24 21				
U Coronæ	15 14.1	+32 01	7.6— 8.7	3 10.9	7 12	14 10	21 7	28 5				
TW Draconis	32.4	+64 14	7.3— 8.9	2 19.4	7 12	15 22	24 8					
SS Libræ	15 43.4	—15 14	9.3—11.5	0 18.4	4 11	12 16	19 20	27 1				
SW Ophiuchi	16 11.1	— 6 44	9.2—10.0	2 10.7	4 13	11 21	19 5	26 13				
SX Ophiuchi	12.6	— 6 25	10.5—11.2	2 01.5	6 10	12 15	18 19	25 0				
R Aræ	31.1	—56 48	6.8— 7.9	4 10.2	6 13	15 9	24 6					
TT Herculis	16 49.9	+17 00	8.9— 9.3	20 18.1	12 4							
TU Herculis	17 09.8	+30 50	9.5—12	2 06.4	3 1	9 20	16 15	23 11				
U Ophiuchi	11.5	+ 1 19	6.0— 6.7	1 16.2	4 4	10 20	17 14	24 6				
u Herculis	13.6	+33 12	4.6— 5.4	2 01.2	4 6	10 10	16 14	28 21				
TX Herculis	15.4	+42 00	8.3— 9.0	2 01.4	4 3	16 12	22 16	28 21				
RV Ophiuchi	29.8	+ 7 19	9. —12	3 16.5	6 13	13 22	21 7	28 16				
SZ Herculis	36.0	+33 01	9.5—10.3	0 19.6	4 6	14 2	23 22	28 19				
TX Scorpii	48.6	—34 13	7.5— 8.2	0 22.6	5 21	12 11	19 1	25 16				
UX Herculis	49.7	+16 57	8.8—10.5	1 13.2	10 6	21 3						
Z Herculis	53.6	+15 09	7.1— 7.9	3 23.8	1 9	9 9	17 8	25 8				
WX Sagittarii	53.6	—17 24	9.2—10.8	2 03.1	2 21	9 6	22 1	28 10				
WY Sagittarii	17 54.9	—23 01	9.5—10.6	4 16.0	2 23	12 7	21 15	26 8				
SX Draconis	18 03.0	+58 23	9.3—10.5	5 04.1	2 21	13 5	23 13	28 18				
RS Sagittarii	11.0	—34 08	5.9— 6.3	2 10.0	7 11	14 17	21 23	29 5				
V Serpentis	11.1	—15 34	9.5—11.1	3 10.9	6 22	13 19	20 17	27 15				
RZ Scuti	21.1	— 9 15	7.4— 8.3	15 03.2	14 8	29 12						
RZ Draconis	21.8	+58 50	9.5—10.2	0 13.2	3 14	11 8	19 1	26 18				
RX Herculis	26.0	+12 32	7.0— 7.6	0 21.3	6 18	15 15	24 13					
SX Sagittarii	39.7	—30 36	8.7— 9.8	2 01.8	3 22	12 5	20 13	28 20				
RR Draconis	40.8	+62 34	9.3—13	2 19.9	3 11	11 23	20 11	28 22				
RS Scuti	43.7	—10 21	9.3—10.3	0 15.9	6 15	14 14	22 14	30 13				
β Lyræ	46.4	+33 15	3.4— 4.1	12 21.8	4 21	17 19	30 17					
U Scuti	18 48.9	—12 44	9.1— 9.6	0 22.9	8 13	16 4	23 20					
RX Draconis	19 01.1	+58 35	9.3—10.2	1 21.4	5 12	13 2	20 15	28 5				
RV Lyræ	12.5	+32 15	11. —12.8	3 14.4	5 0	12 5	19 10	26 14				
RS Vulpec.	13.4	+22 16	6.9— 8.0	4 11.4	3 23	12 22	21 21	30 19				
U Sagittæ	14.4	+19 26	6.5— 9.0	3 09.1	1 1	14 14	21 8	28 2				
Z Vulpec.	17.5	+25 23	7.3— 8.5	2 10.9	6 6	13 15	21 0	28 9				
TT Lyræ	24.3	+41 30	9.4—11.6	5 05.8	3 4	13 15	18 21	29 9				
UZ Draconis	26.1	+68 44	9.0— 9.8	1 15.1	5 2	13 6	21 9	29 13				
SY Cygni	19 42.7	+32 28	10. —12	6 00.2	6 9	12 9	18 9	24 9				
WW Cygni	20 00.6	+41 18	9.3—13.4	3 07.6	3 17	13 16	23 15					
SW Cygni	03.8	+46 01	9. —11.7	4 13.8	10 3	19 7	28 10					
VW Cygni	11.4	+34 12	9.8—11.8	8 10.3	4 1	12 10	20 21	29 7				
RW Capric.	12.2	—17 59	8.8—10.6	3 09.4	2 20	9 15	16 10	23 4				
UW Cygni	19.6	+42 55	10.5—13	3 10.8	5 22	12 12	19 17	26 15				
V Vulpec.	32.3	+26 15	8.2— 9.8	37 19.0	16 9							
W Delphini	33.1	+17 56	9.4—12.1	4 19.4	5 5	14 22	24 11					
RR Delphini	38.9	+13 35	10.5—11.8	4 14.4	1 9	10 14	19 18	28 23				
Y Cygni	48.1	+34 17	7.1— 7.9	2 23.9	2 3	8 3	20 2	26 2				
WZ Cygni	49.3	+38 27	9.9—10.8	0 14.0	2 3	9 6	23 13	30 16				
RR Vulpec.	20 50.5	+27 32	9.6—11.0	5 01.2	4 16	14 19	24 21	29 22				
RY Aquarii	21 14.8	—11 14	8.8—10.4	1 23.2	3 3	9 1	20 20	26 18				
UZ Cygni	55.2	+43 52	8.9—11.6	31 07.3	23 6							
RT Lacertæ	21 57.4	+43 24	9.1—10.5	5 01.7	6 1	16 5	21 7	26 8				
RW Lacertæ	22 40.6	+49 08	10.2—11.2	5 04.4	2 21	8 2	18 10	28 19				
VW Pegasi	22 51.7	+32 42	10.0—10.6	5 06.4	2 2	12 16	23 6	28 13				
Y Piscium	23 29.3	+ 7 22	9.0—12.0	3 18.4	1 10	8 23	16 11	24 0				
TW Androm.	23 58.2	+32 17	8.6—11.5	4 02.9	5 0	13 5	21 11	29 17				

Maxima of Variable Stars of Short Period.

[Calculated by members of the classes in Astronomy at Carleton College.]

Given to the nearest hour in Greenwich civil time; to obtain Eastern Standard time subtract 5^h; Central Standard time 6^h, etc.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of Maxima in 1928							
					November							
	h m	° ′		d h	d h		d h		d h		d h	
SX Cassiop.	0 05.5	+54 20	8.6— 9.2	36 13.7	2 7							
SY Cassiop.	0 09.8	+57 52	9.3— 9.9	4 01.7	2 8		10 12		18 15		26 18	
RR Ceti	1 27.0	+ 0 50	8.3— 9.0	0 13.3	4 15		10 4		15 17		21 5	
RW Cassiop.	1 30.7	+57 15	8.9—11.0	14 19.2	7 5		22 0					
V Arietis	2 09.6	+11 46	8.3— 9.0	0 23.8	7 9		14 8		21 7		28 5	
SU Cassiop.	2 43.0	+68 28	6.5— 7.0	1 22.8	5 13		13 8		21 4		28 23	
RW Camelop.	3 46.2	+58 21	8.2— 9.4	16 00.0			15 20					
SX Persei	4 10.2	+41 27	10.4—11.2	4 07.0	4 5		12 19		21 9		29 23	
SV Persei	42.8	+42 07	8.8— 9.6	11 03.1	3 12		14 15		25 18			
RX Aurigæ	4 54.5	+39 49	7.2— 8.1	11 15.0	8 5		19 20					
SX Aurigæ	5 04.6	+42 02	8.0— 8.7	1 12.8	1 22		14 4		20 7		26 10	
SY Aurigæ	05.5	+42 41	8.4— 9.5	10 03.3	7 13		17 16		27 19			
Y Aurigæ	21.5	+42 21	8.6— 9.6	3 20.6	1 4		8 21		16 15		24 8	
RZ Gemin.	5 56.6	+22 15	9.1—10.0	5 12.7	6 9		17 10		22 23		28 12	
RS Orionis	6 16.5	+14 44	8.2— 8.9	7 13.6	9 6		16 20		24 9		31 23	
T Monoc.	19.8	+ 7 08	5.7— 6.8	27 00.3	15 12							
RT Aurigæ	23.0	+30 33	5.1— 6.0	3 17.5	4 6		11 17		19 4		26 15	
W Gemin.	29.2	+15 24	6.7— 7.5	7 22.0	8 1		15 23		23 21			
ζ Gemin.	6 58.2	+20 43	3.7— 4.3	10 03.7	4 7		14 11		24 14			
RU Camelop.	7 10.9	+69 51	8.5— 9.8	22 06.5	22 3							
RR Gemin.	7 15.2	+31 04	10.0—11.5	0 09.5	2 9		10 8		18 7		26 6	
V Carinæ	8 26.7	—59 47	7.4— 8.1	6 16.7	7 16		14 9		21 1		27 18	
T Velorum	8 34.4	—47 01	7.6— 8.5	4 15.3	3 6		7 22		17 4		26 11	
V Velorum	9 19.2	—55 32	7.5— 8.2	4 08.9	5 0		9 9		18 3		22 12	
Z Leonis	9 46.4	+27 22	7.9— 9.6	56 08.7								
RR Leonis	10 02.1	+24 29	9.1—10.1	0 10.9	1 10		10 11		19 13		28 14	
SU Draconis	11 32.2	+67 53	8.9— 9.6	0 15.8	5 17		12 7		18 22		25 12	
S Muscæ	12 07.4	—69 36	6.4— 7.3	9 15.8	4 19		14 11		24 3			
SW Draconis	12.8	+70 04	8.8— 9.6	0 13.7	4 7		9 23		15 16		21 9	
T Crucis	15.9	—61 44	6.8— 7.6	6 17.6	7 0		13 17		20 11		27 4	
R Crucis	18.1	—61 04	6.8— 7.9	5 19.8	2 9		14 1		19 21		25 17	
S Crucis	12 48.4	—57 53	6.5— 7.6	4 16.6	5 5		9 22		14 15		24 0	
W Virginis	13 20.9	— 2 52	8.7—10.4	17 06.5	7 10		24 17					
SS Hydræ	25.0	—23 08	7.4— 8.1	8 04.8	3 17		11 22		20 3		28 7	
RV Urs. Maj.	13 29.4	+54 31	9.2— 9.9	0 11.2	4 3		13 9		22 20			
ST Virginis	14 22.5	— 0 27	10.3—11.4	0 09.9	7 10		15 15		23 20			
V Centauri	25.4	—56 27	6.4— 7.8	5 11.9	1 10		6 21		17 21		28 21	
RS Bootis	14 29.3	+32 11	8.9—10.0	0 09.1	4 16		12 5		19 18		27 7	
R Trian. Austr.	15 10.8	—66 08	6.7— 7.4	3 09.3	1 10		8 5		15 0		25 4	
S Trian. Austr.	15 52.2	—63 29	6.4— 7.4	6 07.8	7 5		13 12		19 20		26 4	
S Normæ	16 10.6	—57 39	6.6— 7.6	9 18.1	1 22		11 1		22 10			
RW Draconis	33.7	+58 03	9.6—10.8	0 10.6	1 22		8 13		21 20		28 12	
RV Scorpii	16 51.8	—33 27	6.7— 7.4	6 01.5	5 14		11 15		17 17		23 18	
X Sagittarii	17 41.3	—27 48	4.4— 5.0	7 00.3	1 8		15 9		22 9		29 9	
Y Ophiuchi	47.3	— 6 07	6.1— 6.5	17 02.9	7 15		24 18					
W Sagittarii	17 58.6	—29 35	4.3— 5.1	7 14.3	6 19		14 9		21 23		29 14	
Y Sagittarii	18 15.5	—18 54	5.4— 6.2	5 18.6	4 17		16 7		22 1		27 20	
U Sagittarii	26.0	—19 12	6.5— 7.3	6 17.9	7 15		14 9		21 3		27 21	
Y Scuti	32.6	— 8 27	8.7— 9.2	10 08.3	6 15		16 23		27 8			
RZ Lyræ	39.9	+32 42	9.9—11.2	0 12.3	1 23		9 15		17 7		24 23	
RT Scuti	44.1	—10 30	9.1— 9.7	0 11.9	7 14		15 1		22 11		29 22	
κ Pavonis	18 46.6	—67 22	3.8— 5.2	9 02.2	6 9		15 11		24 13			
U Aquilæ	19 24.0	— 7 15	6.2— 6.9	7 00.6	2 3		9 3		16 4		23 4	

Maxima of Variable Stars of Short Period—Continued.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of Maxima in 1928 November							
	h m	° ′		d h	d h	d h	d h	d h	d h	d h	d h	d h
XZ Cygni	30.4	+56 10	8.6— 9.3	0 11.2	3 3	10 3	17 3	24 3				
U Vulpec.	32.2	+20 07	6.5— 7.6	7 23.5	3 12	11 12	19 12	27 12				
SU Cygni	40.8	+29 01	6.2— 7.0	3 20.3	4 5	11 21	19 14	27 6				
η Aquilæ	47.4	+ 0 45	3.7— 4.5	7 04.2	5 18	12 23	20 3	27 7				
S Sagittæ	51.5	+16 22	5.6— 6.4	8 09.2	3 10	11 19	20 5	28 14				
X Vulpec.	19 53.3	+26 17	9.5—10.5	6 07.7	1 21	14 12	20 20	27 4				
X Cygni	20 39.5	+35 14	6.0— 7.0	16 09.3	8 20	25 5						
T Vulpec.	47.2	+27 52	5.5— 6.1	4 10.5	4 18	13 15	22 12	26 22				
UY Cygni	52.3	+30 03	9.6—10.4	0 13.5	3 15	9 6	14 20	26 1				
RV Capric.	55.9	—15 37	9.2—10.1	0 10.7	4 3	13 2	22 1	26 13				
TX Cygni	20 56.4	+42 12	8.5— 9.7	14 17.4	5 13	20 6						
VY Cygni	21 00.4	+39 34	8.8— 9.5	7 20.6	4 9	12 6	20 2	27 23				
SW Aquarii	10.2	— 0 20	9.9—10.8	0 11.0	2 23	12 4	21 8	30 13				
VZ Cygni	21 47.7	+42 40	8.2— 9.2	4 20.7	3 17	8 13	18 7	28 0				
Y Lacertæ	22 05.2	+50 33	9.1— 9.6	4 07.8	2 9	11 0	19 16	28 8				
δ Cephei	25.5	+57 54	3.7— 4.6	5 08.8	1 17	12 11	23 4	28 13				
Z Lacertæ	36.9	+56 18	8.2— 9.0	10 21.1	4 0	14 22	25 19					
RR Lacertæ	37.5	+55 55	8.5— 9.2	6 10.1	7 6	13 16	20 2	26 12				
V Lacertæ	44.5	+55 48	8.5— 9.5	4 23.6	1 15	6 14	11 14	21 13				
X Lacertæ	22 45.0	+55 54	8.2— 8.6	5 10.7	3 4	8 15	19 12	30 9				
SW Cassiop.	23 03.7	+58 11	9.2— 9.7	5 10.6	5 6	10 17	21 14	27 0				
RS Cassiop.	32.6	+61 52	9.0—11.0	6 07.1	3 8	9 15	22 5	28 13				
RY Cassiop.	23 47.2	+58 11	9.3—11.8	12 03.4	7 18	19 21						

Monthly Report of the American Association of Variable Star Observers, for the Months of July and August, 1928.

This is the largest double report presented in several years, reflecting great credit to the many active observers in the Association. This is in part due to the enthusiasm displayed by our three new German contributors, two of whom send in reports for the first time. We regret that our young observer, Clinton Ford, of Ann Arbor, Michigan, must relinquish observing for a year at least, during which time he will be travelling in Europe with his parents. He has made an enviable record, as the present report will well attest, and we all hope he will take up the work again when he returns to his home.

Due to the far southern, and very favorable, location of our Mr. Waterfield, now at Mazelsport, South Africa, and formerly of Nakusp, B. C., and Harvard Observatory, Cambridge, Mass., we are fortunate to have a series of observations on Mira Ceti, which were made about a month earlier than is usual for this southern variable, catching the variable soon after it had passed minimum, on its way up to maximum brilliancy.

R Scuti has been quite completely observed, especially during its recent drop to minimum. SS Cygni has been under the careful watch of many of our observers, and the splendid record of over 200 observations covering the past three months—with only a dozen nights missed—gives one a very thorough knowledge of the actions of this star through one long minimum and the following long maximum. S Apodis, another of the R Cor. Bor. type stars, still remains at minimum, and our southern members are watching its actions very closely.

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1928.

June 0 = J.D. 2424398; July 0 = J.D. 2425428; August 0 = J.D. 2425459.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
V Scl	R And	— Cas	Y And	o Cet	W Per
000339	001838	004746b	013338	*021403*	024356
390[13.3 Bl	450 11.4 Fd	393 10.5 Pt	393 11.1 Pt	437 5.4 Wf	393 9.7 Pt
412[13.3 Bl	451 11.2 Fd	421 10.8 Pt	421 9.0 Pt	440 5.0 Wf	421 9.8 Pt
S Scl	451 10.9 L	451 10.6 Pt	451 10.5 Pt	440 5.1 L	451 10.0 Pt
001032	456 11.3 Fd	W Cas	TT Per	442 5.1 Wf	472 11.0 Cl
390 12.1 Bl	465 10.3 Fd	004958	014453	445 4.9 Ah	R Hor
405 11.4 Dr	466 9.8 Fd	393 12.1 Pt	370 8.4 Br	447 4.8 An	*025050*
413 11.3 Dr	467 9.7 Fd	421 10.5 Pt	X Cas	447 4.0 L	373 9.2 Bl
X And	469 9.4 Fd	441 10.0 Wy	014958	448 3.7 Gy	385 9.5 Bl
001046	469 9.8 Sb	449 9.5 Jo	393 10.3 Pt	450 3.8 L	394 9.4 Bl
400 9.2 Lj	470 9.3 Gb	451 9.0 Pt	414 11.6 Bn	451 3.8 Pt	406 10.9 Bl
407 9.2 Lj	470 9.3 Fd	U Tuc	421 11.0 Pt	453 3.7 Sp	420 11.0 Dr
410 9.4 Lj	471 9.4 Fd	*005475*	443 12.2 Bn	455 3.6 L	T Hor
419 9.4 Lj	472 9.3 Fd	373 8.6 Bl	451 12.0 Pt	457 3.6 L	*025751*
420 9.7 Lj	472 8.0 Kr	385 8.6 Bl	U Per	467 3.0 Gy	385 11.8 Bl
423 9.8 Lj	474 9.1 Fd	394 8.5 Bl	015254	472 2.8 Sp	406 10.6 Bl
426 9.7 Lj	S Tuc	405 9.3 Bl	393 8.8 Pt	S Per	420 8.1 Dr
429 9.6 Lj	*001862*	416 9.3 En	421 9.0 Pt	021558	AA Per
432 9.8 Lj	390[13.2 Bl	421 9.9 Bl	451 9.2 Pt	393 9.0 Pt	030846
437 9.9 Lj	S Cet	Z Cet	R Ari	421 9.0 Pt	378 10.0 Br
439 9.9 Lj	*001909*	*010102*	021024	441 9.3 Wy	396 9.9 Br
450 10.1 Lj	418 10.5 Ch	451 12.1 Pt	407 8.2 Fd	451 9.4 Pt	X Cet
451 10.1 Lj	421 10.8 Pt	U Scl	421 7.6 Pt	RR Per	*031401*
453 10.3 Lj	440 11.7 L	*010630*	439 8.6 Fd	022150	451 9 5 Pt
458 10.2 Lj	447 12.1 An	390 11.0 Bl	441 8.9 Wy	451 9.3 Pt	456 9.3 L
T Cet	452 12.2 L	413 10.2 Dr	449 9.2 Jo	R For	Y Per
001620	T Scl	420 10.4 Dr	450 8.9 Gb	*022426*	032043
440 5.8 L	*002438a*	RU Cep	450 8.8 Fd	390[11.9 Bl	393 9.9 Pt
449 5.8 An	413 9.0 Dr	010884	451 9.0 Pt	U Cet	421 10.0 Pt
450 5.7 L	420 9.1 Dr	446 8.3 L	451 9.1 Fd	*022813*	451 8.8 Pt
455 5.4 L	RR Scl	447 8.7 L	456 9.1 Fd	451 10.0 Pt	R Per
457 5.4 L	*002438b*	449 8.8 L	466 9.7 Fd	RR Cep	032335
T And	413 12.6 Dr	451 8.7 L	467 10.0 Fd	022980	421 9.5 Pt
001726	420 12.7 Dr	452 8.7 L	469 10.2 Fd	390[14.0 L	451 11.5 Pt
444[11.8 Ch	T Phe	455 9.0 L	470 10.0 Fd	433[12.8 L	T Eri
T Cas	*002546*	456 8.9 L	471 9.9 Fd	440[13.4 L	*035124*
001755	390 13.3 Bl	457 9.0 L	472 10.2 Fd	449[13.4 L	420 7.6 Dr
390 8.6 Gt	420 13.8 Dr	459 8.8 L	W And	457 15.0 L	W Eri
393 8.4 Pt	W Scl	S Cas	021143a	R Tri	*040725*
390 8.6 L	*002833*	011272	393 9.5 Pt	023133	373[11.2 Dr
396 8.9 Ch	390 13.0 Bl	451 8.5 Pt	421 10.5 Pt	421 7.8 Pt	420[11.8 Dr
415 8.3 Jo	U Cas	U Psc	451 11.6 Pt	423 8.0 Ah	RY Cam
421 8.0 Pt	004047	011712	T Per	436 7.6 Ah	042164
431 7.9 Wy	472 12.2 Cl	421 11.7 Pt	021258	440 7.7 Ah	370 8.2 Br
436 8.0 Jo	RW And	451 13.5 Pt	393 8.5 Pt	441 7.1 Ah	373 8.2 Br
439 7.9 L	004132	RZ Per	421 8.7 Pt	445 7.1 Ah	380 7.9 Br
441 7.8 Wy	393 12.8 Pt	012350	451 8.4 Pt	445 7.4 Sf	386 7.8 Br
443 7.8 Jo	421 10.4 Pt	410[11.2 Sp	Z Cep	446 7.1 Ah	392 7.9 Br
444 7.7 Ch	444 10.3 Ch	R Psc	021281	449 6.8 Jo	395 8.0 Br
449 7.7 Jo	451 10.2 Pt	012502	451 12.3 Pt	450 6.9 Ah	396 8.0 Br
449 7.9 L	X Scl	451 11.5 Pt	o Cet	451 6.4 Pt	W Tau
451 7.9 Pt	*004435*	RU And	*021403*	453 6.9 Ah	042215
458 7.6 L	390[13.2 Bl	013238	418 7.5 Wf	453 7.1 Sf	451 10.0 Pt
R And	RV Cas	393 11.0 Pt	425 6.9 Wf	459 6.7 Sf	S Tau
001838	004746a	421 10.6 Pt	430 6.5 Wf	466 7.0 Gy	042309
437 12.3 Fd	393 8.0 Pt	451 10.7 Pt	432 6.4 Wf	472 6.8 Sf	451 10.1 Pt
442 12.1 Fd	421 9.5 Pt		434 6.1 Wf		
444 11.6 Ch	451 11.0 Pt		436 5.7 Wf		

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1928.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
T CAM			R DOR			T PIC			RU AUR			R OCT			R GEM		
043065			*043562*			*051247*			053337			*055686*			070122a		
370	9.4	Br	412	5.5	Bl	405	9.3	Bl	379	12.8	Pt	394	7.6	Bl	379	12.0	Pt
373	9.4	Br	415	5.8	Dr	407	9.1	Dr	451	12.4	Pt	400	7.6	Dr	383	12.6	Al
377	9.3	Br	420	5.5	Bl	412	8.9	Bl	SU TAU			404	8.1	Dr	Z GEM		
379	8.8	Pt	R CAE			420	8.8	Bl	054319			405	7.8	En	070122b		
380	9.3	Br	*043738*			T COL			363	9.7	Sf	405	8.3	Bl	379	12.5	Pt
380	9.0	L	373	12.0	Bl	*051533*			379	9.6	Pt	410	8.0	En	383	12.4	Al
386	9.2	Br	375	12.0	Ht	373	10.7	Dr	456	9.9	L	412	8.3	Bl	TW GEM		
390	8.8	L	380	11.7	Dr	373	10.4	Bl	S COL			415	8.3	Dr	070122c		
392	9.1	Br	381	11.7	Sm	375	10.5	Sm	*054331*			416	8.2	En	379	7.8	Pt
395	9.0	Br	385	11.9	Bl	375	10.8	Ht	375	12.6	Ht	420	8.9	Bl	R CMI		
409	8.8	L	406	10.5	Bl	376	10.1	En	376	12.2	En	421	8.7	Dr	070310		
410	8.8	Be	R PIC			379	10.6	Dr	381	12.6	Sm	X AUR			379	10.8	Be
433	8.7	L	*044349*			381	10.6	Dr	385	12.6	Bl	060450			379	10.8	L
441	8.7	Wk	373	8.5	Dr	381	10.5	Sm	386	13.1	Ht	374	9.7	Ch	R VOL		
447	8.2	L	373	8.9	Bl	381	10.5	Ht	387	13.1	Sm	379	9.0	Pt	*070772*		
451	8.0	Pt	375	9.0	Sm	381	10.0	En	406	12.6	Bl	451	11.2	Pt	375	13.0	Ht
457	7.9	L	375	9.0	Ht	385	10.1	Bl	Z TAU			V AUR			376	13.0	En
R RET			376	9.0	En	387	10.5	Sm	054615a			061647			379	13.1	Dr
043263			380	8.9	Dr	394	9.7	Bl	380	13.5	Bf	390	10.2	Sp	381	13.1	Dr
375	12.4	Ht	381	9.0	Sm	395	10.3	Sm	RU TAU			— AUR			381	13.0	Ht
379	12.6	Dr	381	9.2	Ht	405	9.0	Bl	054615c			062047			382	13.0	En
380	12.2	Sm	382	9.2	En	406	9.5	Dr	370	12.9	Bf	381	9.4	Gt	386	12.8	Ht
381	11.4	En	385	9.0	Bl	407	9.2	Dr	380	12.6	Bf	381	9.4	L	386	13.2	Sm
385	12.8	Bl	386	9.3	Ht	412	8.5	Bl	R COL			381	9.5	An	390	12.9	Dr
386	12.2	Sm	387	9.3	Sm	415	8.5	Dr	*054629*			409	9.5	L	401	11.5	Dr
406	12.5	Bl	394	9.0	Bl	S AUR			375	12.6	Ht	410	9.5	Be	404	13.0	En
415	12.5	Dr	405	8.9	Bl	052034			376	12.0	En	456	9.8	L	406	12.0	Dr
X CAM			412	8.2	Bl	379	8.6	Pt	379	12.8	Dr	NOV PIC			407	12.4	Dr
043274			420	8.0	Bl	451	9.5	Pt	381	12.4	Sm	*063462*			413	12.2	Dr
370	10.0	Br	V TAU			W AUR			385	13.0	Bl	370	7.2	Ht	416	12.6	En
373	9.6	Br	044617			052036			386	13.0	Ht	375	7.2	Ht	417	11.8	Dr
377	9.0	Br	451	10.2	Pt	379	9.5	Pt	387	13.0	Sm	375	7.0	Sm	421	11.4	Dr
379	8.8	Pt	T LEP			380	9.2	An	406	13.0	Bl	381	7.0	Sm	423	12.6	Sm
380	8.7	Br	*050022*			380	9.2	L	415	12.4	Dr	381	7.1	Ht	L_2 PUP		
386	8.6	Br	373	10.5	Bl	380	9.3	Be	Z AUR			382	7.0	En	*071044*		
392	8.5	Br	385	11.1	Bl	451	12.6	Pt	055353			385	7.2	Ht	373	4.3	Dr
395	8.4	Br	S PIC			457	12.8	L	379	10.3	Pt	386	6.9	Sm	374	4.4	Dr
396	8.2	Br	*050848*			RR CAM			380	10.4	Pt	394	7.0	Sm	379	4.2	Dr
441	11.8	Wk	376	12.2	En	052372			380	10.3	Br	397	7.1	Ht	381	4.2	Dr
451	12.3	Pt	385	13.4	Bl	370	10.3	Br	384	11.0	Pt	403	7.2	En	390	3.4	Dr
R DOR			406	13.2	Bl	373	10.2	Br	386	11.0	Pt	410	7.2	En	393	3.3	Dr
043562			R AUR			377	10.1	Br	392	10.7	Br	416	7.2	En	401	3.1	Dr
373	5.9	Dr	050953			386	10.0	Br	396	10.8	Br	416	7.2	Ht	404	3.5	Dr
373	5.8	Bl	379	11.0	Pt	392	10.0	Br	398	10.8	Pt	423	6.9	Sm	405	3.6	Dr
375	5.6	Sm	451	12.4	Pt	395	10.0	Br	407	11.0	Pt	S LYN			407	3.7	Dr
375	5.6	Ht	T PIC			396	10.0	Br	451	9.6	Pt	063558			413	3.9	Dr
376	5.5	En	*051247*			S CAM			452	9.5	Pt	354	8.8	Sf	415	4.0	Dr
379	6.1	Dr	375	11.4	Ht	053068			R OCT			379	9.0	Sf	417	4.1	Dr
381	5.8	Sm	376	11.0	En	379	8.3	Pt	*055686*			379	9.0	Pt	421	4.2	Dr
381	5.5	Ht	377	11.5	Sm	437	9.3	Wk	373	7.4	Bl	413	10.8	Sf	424	4.2	Dr
381	5.5	En	379	10.9	Dr	451	8.8	Pt	377	6.6	En	451	13.2	Pt	RR MON		
385	5.8	Bl	381	11.0	Dr	RR TAU			379	7.1	Dr	R LYN			071201		
386	5.5	Ht	381	11.2	Ht	053326			380	7.5	Sm	065355			354	11.5	Sf
387	5.6	Sm	381	11.0	En	370	13.8	Bf	381	7.3	Dr	411	10.5	Ah	363	11.8	Sf
394	5.6	Bl	385	11.0	Bl	376	13.8	Bf	384	6.3	En	445	9.4	Ah	V GEM		
397	5.5	Ht	386	10.6	Sm	380	13.6	Bf	385	7.3	Bl	450	9.3	Ah	071713		
405	5.5	Bl	386	11.0	Ht				386	7.4	Sm	453	9.0	Ah	379	8.8	Pt
406	5.6	Dr	394	10.3	Bl				394	7.6	Sm						

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1928.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
S CMi	W Pup	R Cha	W Cnc	R Car	R Leo
072708	*074241*	*082476*	090425	*092962*	094211
379 12.2 Pt	394 11.6 Bl	376 9.7 En	383 8.4 Al	397 6.3 Ht	410 9.2 Pt
Z Pup	397 11.9 Ht	380 11.0 Sm	383 8.0 Lg	400 6.2 Dr	417 9.5 Ch
072820b	403 11.0 En	382 10.4 En	390 8.3 Be	401 6.3 Dr	419 9.5 An
370 11.0 Bf	405 10.9 Bl	385 10.6 Bl	390 8.3 L	403 6.3 En	Y Hya
376 11.4 Bf	410 10.5 En	386 11.0 Sm	409 8.8 L	404 6.3 Dr	*094622*
380 11.4 Bf	412 10.6 Bl	394 11.0 Sm	410 8.8 Be	405 6.3 Bl	379 6.4 Pt
394 11.4 Bf	416 10.4 En	394 10.6 Bl	410 9.6 Sf	406 6.3 Dr	Z Vel
S Vol	416 10.3 Ht	404 11.0 En	426 10.0 L	410 6.5 En	*094953*
073173	416 9.9 Sm	405 10.8 Bl	RW Car	412 6.4 Bl	373 12.6 Bl
373 9.1 Dr	420 9.9 Bl	412 11.3 Bl	*091868*	413 6.6 Dr	374 12.6 Dr
373 9.2 Bl	423 9.6 Sm	413 11.6 En	377[12.8 En	416 6.9 En	374 12.4 Dw
375 9.5 Ht	T Gem	420 11.7 En	384[12.8 En	416 6.8 Ht	375 12.3 Ht
376 9.3 En	074323	420 11.5 Bl	385[12.8 Bl	417 6.7 Dr	377 12.5 En
377 9.5 Sm	379 10.4 Ch	423 12.2 Sm	406 13.1 Dr	420 6.4 Bl	380 12.7 Dr
380 9.2 Dr	379 10.3 Pt	U Cnc	413 13.2 Dr	421 6.9 Dr	381 12.3 Ht
381 9.3 Sm	Z Cam	083019	421 13.0 Dr	423 7.0 Dr	384 12.5 En
381 9.5 Ht	081473	383 12.0 Lg	Y Vel	423 7.3 Sm	385 12.5 Bl
382 9.5 En	380 12.2 Be	S Hya	*092551*	428 7.9 En	386 12.5 Ht
385 9.3 Bl	380 12.1 L	084803	373 11.1 Bl	X Hya	386 12.8 Sm
386 9.7 Ht	380 12.8 An	379 12.6 Ch	374 11.2 Dw	*093014*	390 12.4 Dr
388 9.5 Sm	388 12.1 L	379 12.5 Pt	374 11.2 Dr	374 11.4 Ch	394 12.5 Bl
390 9.4 Dr	388 12.2 Be	383 12.8 Lg	377 11.3 En	376 11.7 Bf	397 12.3 Ht
394 9.7 Sm	388 11.8 An	T Hya	380 11.3 Sm	379 11.2 Ch	401 11.2 Dr
394 9.9 Bl	388 12.1 Gt	*085008*	381 11.4 Dr	380 11.6 Bf	404 11.3 En
397 9.9 Ht	390 12.2 Gt	379 13.1 Ch	384 11.7 En	383 11.1 Lg	405 11.0 Bl
401 10.2 Dr	390 12.3 L	383 13.0 Lg	385 11.7 Bl	389 11.3 Bf	406 11.0 Dr
404 10.3 Dr	391 12.3 L	393 12.5 Lg	386 11.9 Sm	393 10.2 Lg	410 11.0 En
404 10.7 En	391 12.6 An	T Cnc	390 11.9 Dr	394 10.9 Bf	412 10.7 Bl
405 11.2 Bl	392 12.3 L	085120	394 11.8 Bl	R LMi	413 10.5 Dr
410 11.0 En	394 12.3 L	375 9.8 Ch	401 12.0 Dr	093934	416 10.5 En
412 11.8 Bl	394 12.2 Gt	379 8.3 Pt	405 12.4 En	346 7.0 Gs	416 10.7 Ht
413 10.9 Dr	395 12.3 Gt	T Pyx	405 12.3 Bi	374 7.0 Ch	417 10.1 Dr
416 11.8 En	395 12.4 Be	*090031*	406 12.0 Dr	379 6.7 Ch	420 9.9 Bl
417 11.1 Dr	395 12.4 L	385 [u Bl	410 12.4 En	379 6.9 Pt	421 9.5 Dr
420 11.8 Bl	404 11.0 L	406 [u Bl	416 13.0 En	386 6.7 Fd	423 9.3 Dr
423 11.4 Sm	409 11.7 L	V UMa	421 12.4 Dr	397 7.2 Fd	423 9.8 Sm
U CMi	410 11.9 Be	090151	R Car	405 7.2 Fd	V Leo
073508	429 11.5 L	381 10.6 Gt	*092962*	407 7.4 Fd	095421
370 9.8 An	440 11.1 L	381 10.6 L	373 5.3 Dr	408 7.1 Fd	379 13.1 Pt
379 9.6 Pt	446 12.2 L	391 10.8 L	373 4.9 Bl	408 7.5 Sw	410 13.0 Pt
379 9.5 L	447 12.6 L	391 10.6 An	374 5.5 Dr	409 7.2 Fd	413 12.2 Sf
379 9.3 Be	449 13.1 L	409 10.9 L	374 5.4 Dw	410 7.2 Fd	RV Car
394 9.6 L	451 12.9 L	421 10.4 An	375 5.3 Ht	410 7.6 Pt	*095563*
S Gem	452 12.8 L	426 10.7 L	376 5.4 En	411 7.3 Fd	373 11.1 Bl
073723	455 12.8 L	431 10.7 Be	379 5.5 Dr	413 7.4 Fd	374 11.4 Dw
379 11.4 Ch	456 12.9 L	433 10.7 L	380 5.2 Sm	417 7.7 Ch	374 11.4 Dr
379 12.0 Pt	457 12.5 L	436 10.7 An	380 5.5 Dw	R Leo	377 11.3 En
W Pup	458 12.3 L	441 10.6 An	381 5.4 Ht	094211	380 11.5 Dr
074241	459 10.7 L	441 10.6 Gt	381 5.5 En	370 10.5 An	384 11.3 En
373 12.2 Bl	V Cnc	449 10.4 L	384 5.7 En	379 10.3 Ch	385 11.6 Bl
375 12.4 Sm	081617	458 10.5 L	385 5.6 Bl	379 9.9 Pt	390 11.5 Dr
375 12.2 Ht	379 12.8 Pt	W Cnc	386 5.7 Ht	380 10.4 An	394 12.0 Bl
376 12.6 En	RT Hya	090425	386 5.5 Sm	388 9.9 Wy	401 12.3 Dr
381 12.6 Sm	*082405*	354 9.4 Sf	390 5.9 Dw	390 10.3 An	405 12.5 En
382 12.4 Ht	379 8.0 Pt	361 8.6 Sf	390 5.7 Dr	395 10.1 Fd	406 12.6 Bl
382 12.6 En	R Cha	377 8.5 Sf	393 5.8 Dr	397 9.9 Fd	406 12.7 Dr
385 12.4 Bl	*082476*	379 8.2 Be	394 6.0 Sm	407 9.7 Fd	413 12.8 Dr
386 12.6 Ht	373 9.3 Bl	379 8.2 L	394 6.1 Bl	408 10.1 Sw	413 12.5 En

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1928.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
RV CAR			**W VEL**			**R UMA**			**W LEO**			**RS CEN**			**T VIR**		
095563			*101153*			103769			104814			*111661*			*120905*		
420	12.7	Dr	380	11.7	Sm	408	9.6	Fd	361	13.5	Sf	420	11.9	Bl	388	12.3	Lg
S CAR			384	11.5	En	408	8.9	Sw	376	13.5	Bf	421	11.7	Dr	410	12.6	Sf
100661			385	11.3	Bl	409	9.4	Fd	379	13.0	Pt	423	11.9	Dr	415	13.6	Lg
373	6.1	Dr	386	11.8	Sm	410	9.5	Fd	379	12.6	Ch	423	12.6	Sm	**R CRV**		
373	5.7	Bl	394	11.6	Bl	410	8.9	Pt	379	12.7	Sf	**X CEN**			*121418*		
374	6.3	Dr	405	11.8	Bl	411	9.4	Fd	380	13.2	Bf	*114441*			379	8.9	Be
375	6.0	Ht	412	12.6	Bl	411	9.4	Ah	383	13.4	Lg	374	11.0	Bl	379	8.7	L
376	6.1	En	416[	13.0	En	412	9.3	Fd	389	12.8	Bf	379	11.3	Dr	379	8.9	Pt
379	6.4	Dr	**U HYA**			413	9.3	Fd	410	10.5	Pt	381	11.3	Dw	383	9.0	Cl
380	6.3	Sm	*103212*			413	9.5	Wd	410	10.6	Sf	385	11.4	Bl	388	9.3	Wy
381	6.4	Dr	380	4.8	L	414	9.3	Fd	**RS CAR**			394	11.6	Bl	390	9.1	Gt
381	6.2	Ht	380	5.4	An	415	9.3	By	*110361*			404	12.3	Dr	390	9.1	L
382	6.1	En	380	4.9	Be	415	9.5	Jo	380[	12.3	Sm	405	12.0	Bl	390	9.3	An
385	6.6	Bl	381	5.1	Gt	419	9.4	Ah	384[	12.3	En	406	11.6	Dr	391	9.0	Wd
386	6.3	Sm	381	5.1	L	419	9.4	Fd	414[	12.3	En	407	11.9	Dr	403	10.2	Wy
386	6.2	Ht	388	4.7	L	421	9.9	Wd	423[	12.3	Sm	413	12.7	Dr	404	10.0	Bu
390	6.5	Dw	388	5.3	An	422	9.5	Fd	**S LEO**			420	12.7	Bl	406	10.3	Wy
390	6.5	Dr	388	4.9	Gt	423	10.0	Ah	110506			421	12.6	Dr	408	10.6	Sw
393	6.6	Dr	388	4.9	Be	425	9.4	Fd	379	10.0	Ch	**W CEN**			409	10.3	Cl
394	6.6	Sm	390	5.2	Be	429	10.2	Fd	379	10.0	Pt	*115058*			410	10.6	L
394	6.8	Bl	390	4.9	Gt	433	10.8	Fd	383	10.1	Lg	379[	12.6	En	410	10.1	Pt
397	6.8	Ht	390	5.2	An	436	10.8	Fd	410	10.5	Pt	385	13.0	Bl	411	10.8	An
400	6.9	Dr	395	4.7	L	436	10.0	Jo	**RY CAR**			386[	12.6	Ht	411	10.5	Be
403	7.1	Dr	395	4.7	Be	437	11.3	Wk	*111561*			406	12.2	En	413	10.4	**Wy**
403	7.0	En	**RZ CAR**			437	11.0	Fd	373	12.9	Dr	406	12.0	Bl	418	11.2	Bu
405	7.4	Bl	*103270*			439	11.1	Fd	379	13.0	Dr	412	11.6	Bl	419	10.8	An
406	7.4	Dr	379	10.4	Dr	442	11.4	Fd	381	13.3	Dw	413	11.7	En	419	10.7	Be
407	7.6	Dr	381	10.4	Dr	443	11.2	Pt	385	13.4	Bl	416	11.5	Ht	420	11.1	Wy
410	7.8	En	381	10.6	Dw	444	11.4	Fd	404[	13.1	Dr	419	11.0	En	426	11.5	L
412	7.7	Bl	390	10.3	Dr	444	11.3	By	406	13.6	Bl	420	10.5	Bl	436	11.7	L
413	7.9	Dr	403	10.0	Dr	450	11.9	Fd	413[	13.1	Dr	423	10.7	Sm	**SS VIR**		
415	8.0	Dr	406	10.4	Dr	451	11.7	Fd	**RS CEN**			**R COM**			*122001*		
416	8.2	Ht	407	10.5	Dr	467	11.3	Fd	*111661*			115919			380	8.1	An
416	8.0	Sm	413	10.5	Dr	469	11.4	Fd	373	8.4	Dr	379	8.5	Pt	380	7.7	**L**
416	8.3	En	417	10.8	Dr	470	11.5	Fd	374	8.5	Bl	388	7.3	Lg	380	7.8	**Be**
417	8.0	Dr	421	10.8	Dr	**V HYA**			379	8.5	Dr	389	9.2	Wy	390	7.2	**Gt**
420	8.4	Bl	427	11.3	Dr	*104620*			380	8.6	Sm	406	9.8	Wy	390	7.2	**L**
421	8.2	Dr	**R UMA**			374	9.4	Ch	380	8.3	En	409	9.8	Wy	410	7.1	L
423	8.3	Dr	103769			374	8.9	Bl	381	8.7	Dr	410	9.6	Pt	411	7.5	**Be**
423	8.2	Sm	348	8.0	Gs	379	8.5	Pt	381	8.6	Dw	413	9.8	Wy	411	7.8	**An**
427	8.5	Dr	364	7.9	Ch	379	9.4	Ch	385	9.1	Bl	415	10.3	Lg	426	7.1	L
428	8.7	En	377	8.0	Ch	381	8.9	L	386	9.2	Sm	420	9.8	Wy	433	7.1	L
Z CAR			379	7.9	Pt	381	9.3	An	386	8.6	En	434	10.7	Wy	442	6.9	L
101058			382	8.2	Wd	385	9.0	Bl	390	9.2	Dr	441	10.8	Wy	452	7.0	L
374	14.0	Dw	386	7.9	Fd	394	8.8	L	390	9.2	Dw	441	10.7	Wk	**T CVN**		
374	14.0	Dr	390	8.0	Fd	395	8.8	Bl	393	9.3	Dr	443	10.5	Pt	122532		
377[	12.3	En	391	8.6	Wd	405	8.9	Bl	394	9.7	Sm	**SU VIR**			353	10.0	**Gs**
380[	12.3	Sm	391	8.5	By	412	8.8	Bl	394	9.3	Bl	120012			379	9.1	**Pt**
384[	12.3	En	392	8.6	Wd	420	8.7	Bl	400	9.8	Dr	379	11.5	Ch	383	9.3	**Al**
385[	12.6	Bl	392	8.1	Al	**RS HYA**			403	10.1	Dr	379	11.7	Pt	392	9.0	**Al**
386[	12.3	Sm	395	8.5	Fd	*104628*			405	10.4	Bl	383	11.6	Cl	407	9.4	**Fd**
403[	12.3	Dr	397	8.5	Fd	374	10.5	Bl	406	10.2	Dr	388	11.3	Lg	410	9.7	**Pt**
406[	13.0	Bl	398	8.8	By	385	10.9	Bl	406	10.3	En	410	9.5	Pt	411	9.9	Fd
423[	12.3	Sm	399	9.1	Ah	395	10.4	Bl	412	11.0	Bl	443	10.8	Pt	412	9.8	Fd
W VEL			399	8.9	Wd	405	10.9	Bl	413	10.8	Dr	**T VIR**			413	10.1	**Fd**
101153			401	8.8	Ch	412	10.9	Bl	413	10.8	En	*120905*			419	10.5	Fd
373	10.9	Bl	404	8.8	Ah	420	11.0	Bl	415	11.0	Dr	379	12.1	Sf	420	10.2	**Wy**
377	11.4	En	407	9.6	Fd				420	11.6	En	379	12.0	Pt	437	10.8	Fd

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1928.

J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs.

T CVn 122532
441 10.7 Wy
441 10.9 Wk
443 11.0 Pt

Y Vir *122803*
376 13.3 Bf
379 13.1 L
380 13.4 Bf
388 13.2 Lg

U Cen *122854*
374 9.5 Bl
385 8.8 Bl
394 8.3 Bl
405 8.1 Bl
412 7.8 Bl
420 7.8 Bl

T UMa 123160
364 8.3 Ch
379 8.5 Pt
383 8.3 Al
386 8.7 Fd
392 8.4 Al
397 8.9 Wd
399 8.8 Ah
404 8.9 Ah
406 9.0 Ah
407 9.1 Fd
408 8.8 Al
408 9.2 Sw
410 9.1 Ah
410 8.6 Pt
411 9.1 Ah
412 9.1 Fd
413 9.1 Fd
413 9.0 Wd
414 9.0 Fd
415 9.5 Jo
416 9.3 Ch
419 9.1 Fd
419 9.5 Ah
423 9.6 Ah
425 9.3 Fd
427 9.7 Ah
429 9.3 Fd
433 9.4 Fd
433 9.7 Bh
433 10.0 Ch
434 10.2 Hs
436 10.0 Jo
436 10.2 Sw
436 10.0 Wd
436 10.1 Ah
436 9.7 Fd
437 10.2 Fd
437 10.1 Wk
437 9.6 So

T UMa 123160
439 10.9 Fd
440 10.1 Ah
442 10.4 Fd
443 10.7 Pt
445 10.4 Ah
445 10.3 Hs
446 10.1 Hs
450 10.6 Ah
469 12.0 Fd
471 11.0 Kr

R Vir 123307
379 8.0 Pt
390 7.7 Wy
399 7.0 Ah
404 6.9 Ah
406 6.9 Ah
410 6.9 Ah
410 6.3 Pt
411 7.0 Ah
418 7.0 Bu
419 7.5 An
419 6.9 Be
419 7.0 Ah
427 7.3 Ah
433 8.0 Be
433 8.4 An
436 7.3 Ch
437 8.6 Ah
440 8.7 Ah
442 9.3 An
443 9.0 Pt

RS UMa 123459
376 13.4 Bf
379 13.4 Pt
380 13.6 Bf
383 13.5 Al
394 13.6 Bf
410 14.3 Pt
443 14.0 Pt
471 12.0 Fd

S UMa 123961
364 8.5 Ch
370 8.7 An
379 8.2 Pt
380 8.4 An
383 8.0 Al
386 8.4 Fd
390 8.1 An
392 7.8 Al
397 8.5 Wd
398 7.5 By
399 7.7 Ah
400 8.1 Lj
403 8.2 Lj
404 7.7 Ah

S UMa 123961
405 7.7 By
406 7.6 Ah
407 8.1 Lj
407 7.9 Fd
408 7.0 Al
410 8.1 Lj
410 7.7 Ah
410 7.5 Pt
411 7.6 Ah
412 8.0 Fd
413 8.1 Fd
413 7.9 An
413 8.3 Wd
413 8.4 Jn
414 7.9 Fd
415 7.5 Jo
415 8.0 By
416 8.1 Ch
416 7.6 Ah
419 7.5 Ah
419 8.1 Lj
419 8.1 Fd
423 8.1 Lj
423 7.9 Ah
424 8.4 An
426 8.2 Lj
427 7.9 Ah
429 8.2 Lj
429 8.2 Fd
430 3.1 Ah
430 8.2 Wd
433 8.7 Bh
433 8.8 Jn
433 8.3 Ch
433 8.2 Fd
436 6.8 Jo
436 8.5 Wd
436 8.3 Ah
436 8.2 Fd
437 8.2 Fd
437 8.5 Lj
437 8.3 Ah
438 8.5 An
438 8.6 Gt
439 8.2 Fd
439 8.7 Lj
440 8.3 Ah
441 8.4 Ah
442 8.3 Fd
443 8.6 Pt
443 8.6 Jo
448 8.8 An
449 8.6 Jo
450 8.6 Ah

S UMa 123961
451 9.2 Lj
451 8.9 By
452 9.2 Lj
452 8.8 Gt
452 8.9 Jo
453 9.4 Lj
453 8.8 Ah
457 9.0 Wd
458 9.4 Lj
458 8.9 Gt
458 8.9 By
459 8.9 Fd
460 9.2 Fd
464 9.2 By
465 10.0 Jn
469 8.9 Fd
470 9.2 Fd
471 9.5 Fd
471 9.5 Kr
472 9.2 Wd
472 10.1 Kz
479 10.2 By

RU Vir 124204
379 13.0 Pt
388 13.3 Lg
410 13.0 Pt
415 12.1 Lg
443 13.2 Pt

U Vir 124606
379 10.9 Pt
388 12.3 Lg
408 12.5 Al
410 12.6 Pt
415 12.5 Lg

RV Vir *130212*
388 14.0 Lg
413 12.0 Sf
415 12.0 Lg
434 11.9 Sf
444 12.0 By

U Oct *131283*
375 13.2 Sm
381 13.2 Sm
385 13.6 Bl
387 13.2 Sm
404 13.7 Dr
406 14.0 Bl
413 13.7 Dr
421 13.3 Dr

V Vir *132202*
388 13.4 Lg
415 13.0 Lg
435 11.9 Wy

R Hya *132422*
364 9.1 Ch
374 8.5 Bl
375 8.6 Sm
379 8.1 Pt
380 7.7 L
380 8.3 En
381 8.7 Sm
385 8.2 Bl
386 8.2 En
387 8.0 Sm
390 7.4 L
390 7.4 Gt
394 7.6 Bl
395 7.3 Sm
403 7.4 En
405 7.0 Bl
410 7.0 En
410 6.3 L
410 6.2 Pt
411 7.0 An
412 6.5 Bl
416 6.8 En
416 6.3 Sm
417 6.8 Ch
420 6.8 Bl
426 6.1 L
436 6.0 Ch
436 6.2 L
442 6.1 L
453 6.1 L

S Vir *132706*
364 7.7 Ch
375 6.8 Sm
379 7.1 Pt
381 6.7 Sm
387 6.8 Sm
387 6.7 Sp
388 6.6 Lg
391 6.8 Sp
393 6.6 Lg
395 6.5 Sm
402 7.5 Sb
405 6.8 Sp
406 7.1 Lg
409 7.1 Sb
410 6.7 Pt
413 7.1 Sw
415 7.2 Lg
416 6.8 Sm
417 7.2 Ch
430 7.4 Sw
435 6.2 Sb

S Vir *132706*
441 8.0 Lg
442 7.5 Sp
443 7.7 Pt

R Hya *132422*
461 8.6 Sb

RV Cen *133155*
374 7.7 Bl
380 7.4 Dr
381 7.7 Dw
381 7.7 Dr
385 7.6 Bl
390 7.8 Dr
394 7.6 Bl
404 7.1 Dr
405 7.7 Bl
406 7.5 Dr
412 7.7 Bl
413 7.8 Dr
423 7.3 Dr

T UMi 133273
442 11.7 Fd
450 11.9 Fd
456 11.0 Fd
466 9.8 Fd
467 9.8 Fd
469 9.8 Fd
470 10.0 Fd
471 9.5 Fd
472 9.1 Fd
474 9.9 Fd

T Cen *133633*
370 8.4 Ht
374 8.2 Bl
375 8.2 Ht
375 8.8 Sm
379 8.0 Dr
380 8.1 Dr
380 8.7 En
381 8.2 Sm
382 8.4 Ht
385 8.0 Ht
386 7.6 Sm
386 7.3 En
386 7.5 Bl
390 7.2 Dr
393 7.0 Dr
394 6.7 Bl
397 6.7 Ht
400 6.4 Dr
404 6.6 Dr
405 6.3 Bl
406 6.5 Dr
406 6.8 En
412 6.0 Bl
413 6.5 En
413 6.2 Dr

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1928.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
T CEN			**T APS**			**R CEN**			**U UMI**			**V BOO**			**R BOO**		
133633			*134677*			*140959*			141567			142539a			143227		
415	6.1	Dr	405	8.2	Bl	375	5.8	Ht	449	8.7	Jo	419	8.0	Fd	419	12.3	Lj
419	6.4	En	406	8.5	Dr	375	5.9	Sm	450	8.5	Lj	422	8.6	Fd	420	12.3	Lj
420	6.5	Bl	412	8.4	Bl	376	6.0	En	450	8.4	Ah	425	7.9	Fd	423	12.3	Lj
421	6.3	Dr	413	8.6	Dr	380	6.3	Ht	452	8.4	Lj	429	7.7	Fd	426	12.0	Lj
424	6.2	Dr	413	8.6	En	380	6.0	Dr	452	8.6	Jo	430	7.3	Fd	437	10.0	Wk
429	6.7	Bh	420	8.7	En	380	6.2	Dw	453	8.5	Ah	430	8.0	Be	437	10.7	Lj
RT CEN			420	8.5	Bl	381	6.0	En	454	8.4	Lj	430	8.1	An	439	10.4	Lj
134236			421	8.4	Dr	381	5.9	Sm	458	8.4	Lj	431	7.4	Fd	439	10.6	Ch
374	11.1	Bl	423	8.8	Sm	386	5.9	Ht	472	7.7	Cl	433	7.6	Fd	443	9.9	Pt
375	10.9	Ht	424	8.6	Dr	386	5.8	Bl	**S BOO**			434	7.5	Fd	445	9.4	Hs
375	10.8	Sm	**RR VIR**			387	6.1	Sm	141954			436	7.5	Fd	446	9.3	Hs
379	11.5	Dr	*135908*			394	6.0	Bl	379	12.2	Pt	436	7.7	Jo	448	9.4	Ch
380	11.1	En	379	13.1	Pt	397	6.4	Ht	380	11.6	L	436	7.9	Sw	450	9.5	Lj
381	11.1	Sm	388	14.0	Lg	400	6.0	Dr	380	11.9	An	437	7.6	Fd	451	9.5	Lj
382	10.7	Ht	410	13.5	Pt	403	6.6	En	390	11.8	Gt	439	7.6	Fd	454	9.1	Lj
386	10.4	Ht	415	14.0	Lg	404	6.4	Dr	390	11.9	L	439	7.9	Be	458	8.8	Lj
386	11.0	Bl	441	13.0	Lg	405	6.4	Bl	410	10.3	Pt	439	7.8	An	458	8.5	Hs
386	10.9	En	**Z BOO**			410	6.4	En	416	10.0	Ch	439	8.0	Ch	462	8.5	Hs
387	10.6	Sm	140113			412	6.6	Bl	419	9.6	Be	442	7.4	Fd	**V LIB**		
394	10.1	Bl	370	9.3	Br	413	6.9	Dr	419	9.0	An	443	7.9	Wy	*143417*		
397	10.0	Ht	371	9.4	Br	416	6.9	Ht	426	9.4	L	443	7.8	Jo	390	13.0	Lg
404	9.6	Dr	373	9.4	Br	416	7.0	En	430	9.2	Be	443	7.4	Pt	405	11.1	Sp
405	9.6	Bl	375	9.4	Br	416	6.6	Sm	430	9.0	An	444	7.4	Fd	413	10.5	Sp
406	9.5	Dr	377	9.8	Br	420	6.9	Bl	433	9.0	Ch	449	7.7	Jo	442	10.0	Sp
406	9.6	En	379	10.0	Br	421	7.0	Dr	436	8.9	Sw	450	7.8	Gb	**Y LUP**		
412	9.4	Bl	389	10.4	Br	428	7.4	En	436	9.0	Sp	450	7.2	Fd	*145254*		
413	9.2	Dr	392	10.8	Br	**U UMI**			436	9.9	L	451	7.3	Fd	379	13.7	Dr
413	9.6	En	395	11.1	Br	141567			439	8.5	An	452	7.2	Fd	386	13.7	En
419	9.3	En	396	11.2	Br	379	11.3	Pt	439	8.7	Be	452	7.4	Jo	404	13.7	Dr
420	9.4	Bl	**Z VIR**			383	11.1	Cl	442	8.8	L	453	7.3	Fd	406	13.7	Bl
421	9.2	Dr	*140512*			400	9.6	Lj	443	8.4	Pt	455	7.1	Fd	413	14.0	Dr
424	9.2	Dr	379	11.2	Pt	404	8.8	Ah	443	8.3	Wy	455	7.6	An	414	13.7	En
RCVN			388	11.4	Lg	405	9.2	Lj	443	8.4	Jo	456	7.4	Fd	421	12.4	En
134440			391	11.2	Sp	407	8.8	Lj	445	8.3	Ch	457	7.5	Fd	**S APS**		
379	8.4	Pt	405	11.3	Sp	408	8.8	Al	449	7.8	Jo	458	7.5	Fd	*145971*		
410	7.5	Pt	410	11.7	Pt	410	8.9	Ah	452	7.7	Jo	459	7.6	Fd	374	13.4	Bl
437	7.6	Wk	413	11.4	Sp	410	8.8	Lj	454	8.2	L	460	7.7	Fd	375	13.2	Sm
443	7.7	Pt	415	11.5	Lg	410	8.6	Pt	471	8.4	Jo	462	7.5	Fd	380	13.2	Sm
RX CEN			441	13.0	Lg	412	8.8	Ah	**RS VIR**			465	7.5	Fd	386	13.4	Bl
134536			**RU HYA**			414	8.5	Lj	142205			466	7.4	Fd	385	13.4	Ht
374	10.3	Bl	*140528*			416	8.8	Ah	378	12.8	Bf	467	7.5	Fd	388	13.2	Sm
386	11.3	Bl	375	12.5	Sm	417	8.6	Ch	384	12.7	Bf	469	7.5	Fd	395	13.4	Bl
394	11.5	Bl	380	13.0	Dr	419	9.4	Ah	394	13.2	Bf	470	7.4	Fd	406	14.0	Bl
405	11.7	Bl	380	12.2	En	419	8.5	Lj	**V BOO**			471	7.6	Fd	412	14.0	Bl
412	11.9	Bl	381	12.5	Sm	423	8.5	Lj	142539a			471	7.0	Jo	416	13.4	Ht
420	12.5	Bl	385	13.0	Bl	423	8.9	Ah	379	9.5	Pt	473	7.4	Gu	420	13.7	Bl
T APS			386	13.0	En	426	8.5	Lj	390	10.1	Fd	**R CAM**			**RT LIB**		
134677			387	13.0	Sm	427	8.7	Ah	392	8.8	Al	142584			*150018*		
374	10.8	Bl	388	12.9	Lg	429	8.4	Lj	405	9.1	Fd	396	8.3	Wy	375	8.7	Sf
375	11.5	Sm	404	13.3	Dr	437	8.4	Lj	407	8.8	Fd	441	9.7	Wk	379	8.6	Pt
379	10.2	Dr	406	13.3	Bl	437	8.7	Ah	408	9.1	Fd	**R BOO**			388	9.4	Lg
379	10.5	En	413	13.3	Dr	439	8.5	Lj	410	8.3	Pt	143227			410	10.0	Pt
384	9.6	En	421	13.6	Dr	440	8.7	Ah	412	8.5	Fd	374	11.4	Ch	413	10.4	Sf
386	9.4	Bl	**R CEN**			441	8.8	Ah	413	8.5	Fd	379	11.5	Pt	415	10.3	Lg
386	10.0	Sm	*140959*			443	8.5	Pt	414	8.2	Fd	403	12.3	Lj	434	11.6	Sf
394	8.9	Bl	372	6.1	Dr	445	8.4	Ah	415	8.3	Al	410	12.3	Lj	441	11.8	Lg
404	8.6	Dr	373	6.1	Dr	445	8.5	Ch	416	8.3	Ch	410	12.3	Pt	443	12.1	Pt
405	8.6	En	374	5.7	Bl	446	8.5	Ah	419	8.7	An	415	11.9	Al	444	11.9	Sf

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1928.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
T LIB	S SER	RU LIB	S UMI	R CRB	R CRB
150519	151714	*152714*	153378	154428	154428
379 11.6 Pt	443 11.9 Pt	388 9.7 L	400 11.4 Lj	379 6.1 Pt	407 6.1 Pt
381 11.2 Sf	444 11.9 L	392 9.2 Gt	403 11.5 Lj	379 6.1 Be	407 6.2 Lj
388 10.7 Lg	449 11.9 Lg	394 9.4 L	410 11.6 Lj	380 6.0 L	408 5.9 Fd
405 10.4 Sf	454 11.8 L	404 8.4 Sb	410 10.8 Pt	380 6.1 Pt	408 5.7 Sw
410 10.0 Pt	467 10.7 Lg	410 8.2 Pt	415 11.3 Al	380 6.3 An	409 6.1 Pt
415 11.3 Lg	S CRB	411 8.3 Sb	419 11.5 Lj	381 5.9 An	409 6.1 L
434 12.0 Sf	151731	423 7.6 L	419 11.3 Lg	381 6.1 Gt	409 6.1 Sb
441 12.4 Lg	379 12.1 Pt	427 7.9 An	426 11.3 Lj	381 6.1 L	410 6.2 Lj
443 12.7 Pt	386 12.4 Wy	436 8.0 L	429 11.1 Lj	382 6.1 Be	410 6.0 Be
Y LIB	388 12.1 Ch	437 8.3 Be	437 10.8 Lj	382 6.0 Wd	410 6.1 L
150605	410 12.4 Pt	437 8.1 An	439 10.7 Lj	384 6.1 Pt	410 6.2 Pt
380[13.2 Be	418 12.4 Ch	437 8.0 Gt	441 10.5 Lg	386 6.1 Pt	411 6.2 Lj
380 13.6 L	437 12.6 Wk	442 8.4 L	443 10.0 Pt	386 6.0 Gb	411 6.0 Be
390 12.9 L	437 12.3 Fd	443 8.4 Pt	451 10.5 Lj	387 6.1 Sp	411 6.1 Ah
390 12.9 Gt	443 12.4 Pt	447 8.3 An	452 10.5 Lj	387 6.1 Pt	411 6.2 Pt
410 13.2 L	445 12.5 Ch	453 8.8 L	454 10.2 Lj	388 6.1 Pt	412 6.2 Pt
415 11.5 Lg	462 12.1 Sb	459 9.1 L	458 10.2 Lj	388 6.1 Be	412 6.0 Fd
421[13.0 An	470 11.9 Fd	462 8.9 Sb	467 9.7 Lg	388 6.1 Gt	413 5.9 Fd
436 13.4 L	471 11.7 Fd	R NOR	U LIB	388 6.0 L	413 6.0 Jn
437[12.6 Be	474 11.8 Fd	*152849*	*153620a*	388 5.9 An	413 6.1 Pt
437[12.9 An	RS LIB	374 7.5 Bl	386[13.1 Bl	389 6.2 Pt	413 6.1 Sw
437[12.9 Gt	*151822*	375 7.5 Sm	406[12.9 Bl	390 6.1 Gt	413 6.3 Wd
442 13.3 L	374 7.6 Bl	379 8.0 En	T NOR	390 5.8 Fd	414 6.1 Pt
447 12.5 An	375 7.9 Ht	380 7.3 Dw	*153654*	390 6.1 L	414 5.8 Fd
458 11.2 Gt	375 7.7 Sm	380 7.3 Dr	375 10.0 Sm	390 6.2 Pt	415 6.0 Be
S LIB	379 7.0 En	381 7.5 Sm	375 10.4 Ht	390 6.1 An	415 5.9 Jo
151520	381 7.7 Sm	384 7.2 En	379 9.7 En	391 6.0 L	417 6.1 Ch
375 10.8 Ch	382 8.1 Ht	386 7.6 Bl	379 9.6 Dr	391 6.2 Wd	418 6.1 Pt
379 11.0 Pt	386 8.2 Ht	388 7.5 Sm	381 9.3 Dw	391 6.0 An	418 6.1 Gt
381 11.1 Gt	386 8.0 Bl	394 7.3 Sm	381 9.3 Dr	392 6.1 Gt	419 6.1 Be
381 11.2 L	387 7.9 Sm	395 7.2 Bl	381 9.7 Sm	392 6.1 L	419 6.0 Ah
391 11.7 L	388 8.0 An	404 7.2 Dr	382 10.1 Ht	392 6.2 Pt	419 6.2 Lj
381 11.4 An	388 7.9 Gt	406 6.8 Bl	384 9.3 En	392 6.2 Wd	419 6.1 An
410 11.5 Pt	388 8.0 Be	407 7.5 Dr	386 9.3 Ht	394 6.1 Gt	419 6.2 Pt
417 11.5 Ch	388 7.9 L	407 7.2 En	388 8.3 Sm	394 6.0 Be	419 5.9 Fd
420 10.9 An	394 8.0 Gt	412 7.2 Bl	394 7.5 Sm	394 6.1 L	420 6.2 Pt
431 10.3 L	394 8.3 L	413 7.4 Dr	397 7.2 Ht	394 6.2 Pt	420 6.1 Lj
441 9.7 An	394 7.9 Sm	413 7.5 En	400 7.2 Dr	395 6.1 Gt	420 6.0 An
441 9.6 Gt	395 7.7 Bl	416 7.6 Sm	404 7.1 Dr	395 6.2 Pt	421 6.2 Pt
442 9.7 L	397 8.6 Ht	420 7.4 En	406 6.9 Dr	396 6.2 Ch	421 6.2 Wd
443 9.2 Pt	403 8.8 En	420 7.7 Bl	407 6.5 En	397 6.2 Pt	422 6.2 Pt
448 9.4 Ch	405 8.7 Bl	421 7.7 Dr	413 6.5 En	397 6.3 Wd	422 6.1 Gt
453 9.1 L	410 9.8 En	423 7.7 Sm	413 6.6 Dr	398 6.2 Pt	424 6.2 Pt
458 9.7 Gt	412 9.4 Bl	424 7.7 Dr	416 6.5 Sm	399 6.2 Pt	425 6.2 Pt
459 9.1 L	416 9.9 En	X LIB	416 6.4 Ht	399 6.3 Wd	425 6.1 Ch
S SER	416 9.0 Ht	*153020*	420 6.5 En	400 6.1 Pt	425 6.1 An
151714	416 9.6 Sm	386 12.3 Bl	421 6.3 Dr	400 6.1 Lj	426 6.1 An
380 13.5 L	420 9.2 Bl	406[12.9 Bl	424 6.4 Dr	400 6.1 Sw	426 6.2 Lj
388 13.4 An	421 10.0 An	W LIB	Z LIB	401 6.2 Lj	426 6.0 Be
404 12.4 L	423 10.0 Sm	*153215*	*154020*	401 6.1 Ah	427 6.0 Lj
420 12.0 Wy	431 10.4 L	386 12.8 Bl	386[13.0 Bl	401 6.3 Sb	427 6.0 Ah
420 12.2 An	433 10.5 An	388 13.5 Lg	406[12.7 Bl	403 6.1 Lj	429 6.1 Be
423 12.0 L	442 10.6 An	406 13.1 Bl	R CRB	403 6.1 Be	429 6.1 Lj
433 11.9 An	442 10.2 L	436[13.5 L	154428	404 6.0 L	431 6.4 Wy
433 12.0 Be	454 10.6 L	449[13.5 Lg	363 6.1 Ch	405 6.1 Sp	431 6.1 Pt
436 12.0 Lg	RU LIB	S UMI	368 6.1 Ch	405 6.2 Pt	431 6.0 Lj
441 12.2 Lg	*152714*	153378	369 6.1 Gt	405 6.0 Gt	431 6.0 Fd
442 11.7 An	379 11.0 Pt	379 10.9 Pt	377 6.1 Ch	407 5.9 Fd	432 6.0 Bh

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J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.
R CrB		R CrB		X CrB		RR Lib		Z Sco		U Ser	
154428		154428		154536		*155018*		*160021*		160210	
433	6.0 Bh	450	6.0 Gb	371	9.4 Br	413	11.8 Sp	444	10.0 L	433	8.2 Fd
433	6.0 Jn	450	6.2 Lj	373	9.4 Br	417	12.0 Ch	452	10.0 L	434	8.3 Fd
433	6.2 Pt	450	6.1 Pt	375	9.3 Br	418	11.7 Ch	R Her		436	8.2 Fd
433	6.0 Be	451	6.2 Pt	377	9.3 Br	428	10.5 An	160118		437	8.3 Fd
433	6.1 An	451	6.1 Lj	379	9.5 Br	431	10.5 L	368	10.0 Ch	439	8.1 Fd
433	5.9 Fd	451	6.0 Fd	386	9.7 Br	435	9.8 An	375	9.8 Ch	439	8.6 An
434	5.9 Bh	452	5.9 Fd	389	9.7 Br	436	10.2 Ch	379	9.4 Pt	442	8.0 Fd
434	6.2 Pt	452	6.2 Lj	392	9.7 Br	439	9.7 Be	398	9.0 By	443	8.5 Pt
435	6.2 Wd	452	5.8 Jo	396	9.8 Br	442	9.5 L	405	9.6 By	444	7.8 Fd
435	6.2 Pt	452	6.1 Gt	397	9.5 Pt	442	9.4 Sp	407	9.6 Fd	448	8.7 An
435	6.1 An	452	6.0 L	410	9.8 Pt	443	10.0 Pt	410	9.7 Pt	450	8.6 Fd
435	6.1 Sb	452	6.1 Pt	443	11.5 Pt	453	9.3 L	412	9.6 Fd	451	8.5 Fd
436	6.0 Jo	453	6.2 Lj	R Ser		472	8.5 Sp	414	9.5 Eb	455	8.7 Fd
436	6.2 Wd	454	6.2 Lj	154615		Z CrB		414	9.3 Kz	456	8.8 Fd
436	6.2 Pt	454	6.1 L	364	9.3 Ch	155229		415	9.3 By	457	8.7 Fd
436	5.9 Fd	455	6.1 An	379	9.8 Pt	419	14.0 Lg	417	9.5 Ch	458	9.0 Fd
437	6.0 Fd	456	6.1 Pt	410	11.3 Pt	467	11.4 Lg	419	9.7 Fd	459	8.8 Fd
437	6.2 Pt	456	6.0 Fd	418	12.4 Ch	RZ Sco		437	9.9 Fd	460	8.9 Fd
437	6.0 Be	457	6.1 Pt	437	12.3 Wk	*155823*		439	10.0 Fd	462	9.0 Fd
437	5.9 Wk	457	6.2 Wd	443	13.4 Pt	375	9.3 Ht	442	9.9 Fd	465	9.0 Fd
437	6.0 Lj	458	6.2 Lj	V CrB		375	9.3 Sm	443	10.0 Pt	466	9.1 Fd
437	6.0 Ah	458	6.0 Gt	154639		379	10.0 Pt	444	9.9 Fd	467	9.3 Fd
437	6.2 An	458	6.1 L	379	10.0 Pt	379	9.5 En	444	9.7 By	469	9.6 Fd
437	6.1 Gt	458	6.1 Pt	410	9.0 Pt	381	9.6 Sm	446	9.9 Ch	470	9.8 Fd
438	6.1 Gt	458	5.9 Fd	419	10.4 Lg	382	9.7 Ht	450	10.1 Pt	471	9.9 Fd
439	6.2 Pt	459	6.0 Fd	443	7.3 Pt	386	10.5 Ht	451	10.1 P	472	10.2 Fd
439	6.1 Be	459	6.0 L	467	7.7 Lg	386	9.7 En	452	10.4 Fd	474	10.0 Fd
439	6.4 Gs	459	6.0 Be	R Lib		387	10.0 Sm	452	10.8 By	X Sco	
439	6.2 Lj	460	6.1 Pt	*154715*		394	10.8 Sm	456	10.7 Fd	*160221a*	
439	6.0 An	460	5.9 Fd	410	11.0 Sp	397	10.8 Ht	457	10.9 Fd	386	13.0 Bl
439	5.9 Ch	461	6.1 Pt	434	11.5 Wy	403	10.8 En	458	11.0 By	406	13.0 Bl
439	6.0 Fd	462	6.2 Pt	443	10.9 Pt	410	11.4 En	462	11.2 Fd	SX Her	
440	6.1 Lj	462	6.1 Fd	465	11.2 By	410	11.0 Pt	464	11.2 By	160325	
440	6.0 Gy	463	6.1 Sb	472	10.8 By	416	11.5 Ht	465	11.7 Fd	370	8.0 Br
440	6.0 L	464	6.2 P	R Lup		416	11.8 Sm	466	11.6 Fd	371	8.0 Br
441	6.0 Be	465	5.8 Jn	*154736*		416	11.5 En	467	11.8 Fd	373	8.0 Br
441	6.0 Ah	465	6.2 Pt	380	13.4 Dr	423	11.4 Sm	469	11.7 Fd	379	8.0 Br
441	6.0 An	465	6.0 Fd	381	13.4 Dw	443	12.1 Pt	470	11.7 Fd	379	8.0 Pt
441	6.1 Gt	466	5.9 Fd	381	13.5 Dr	Z Sco		471	11.6 Fd	380	8.2 Pt
442	6.1 Pt	466	6.0 Gy	404	13.1 Dr	*160021*		472	12.0 Fd	384	8.0 Pt
442	6.1 Sp	467	6.5 P	407	12.6 En	385	12.0 Ht	479	12.8 By	386	8.0 Fd
443	5.8 Jo	467	6.1 Pt	413	13.1 Dr	386	12.0 Bl	U Ser		387	8.1 Pt
443	6.1 Pt	468	6.2 Pt	421	12.6 En	388	12.0 L	160210		388	8.0 Pt
444	6.2 Pt	469	5.9 Fd	ST Her		395	11.9 Bl	379	11.3 Pt	388	7.9 L
444	6.1 Sp	469	6.2 Pt	154748		406	11.7 En	386	10.7 Fd	389	8.2 Br
444	6.6 An	470	6.2 Pt	398	7.4 By	406	11.7 Bl	395	9.5 Fd	389	8.0 Pt
444	5.9 L	470	6.1 Fd	405	7.4 By	412	11.4 Bl	397	9.2 Fd	390	8.1 Pt
444	6.0 Fd	470	5.9 Sb	415	7.5 By	413	11.5 En	407	9.0 Fd	391	7.9 An
445	6.1 Pt	471	6.0 Fd	444	6.9 By	416	11.2 Sm	408	8.8 Fd	391	7.9 L
445	6.1 Ah	471	6.2 Pt	451	8.2 By	416	11.5 Ht	410	8.8 Fd	392	8.3 Br
446	6.6 Gs	471	6.0 Kr	458	8.2 By	419	11.3 An	410	8.2 Pt	392	8.1 L
446	5.9 Ch	471	6.0 Sp	464	8.0 By	419	11.2 En	411	8.7 Wy	393	8.0 Pt
447	6.0 L	472	6.2 Wd	479	7.7 By	420	11.1 Bl	411	8.6 Fd	395	8.4 Br
447	6.1 Pt	474	5.9 Fd	RR Lib		423	11.0 Sm	412	8.7 Fd	395	8.1 Pt
449	6.0 Ch	476	6.2 Sb	*155018*		431	10.6 L	413	8.7 Fd	396	8.4 Br
449	6.0 Jo	X CrB		388	13.7 L	433	10.0 An	414	8.8 Fd	397	8.1 Pt
449	6.0 Sb	154536		394	14.0 L	433	10.9 Be	419	8.1 Fd	398	8.1 Pt
450	5.9 Fd	370	9.4 Br	410	12.5 Pt	442	10.0 An	431	8.3 Fd	400	8.0 Pt

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1928.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
SX HER			**RU HER**			**S SCO**			**U HER**			**g HER**			**W HER**		
160325			160625a			*161122b*			162119			162542			163137		
405	8.1	Pt	413	11.6	Sp	386[	13.2	Bl	380	12.7	Pt	356	5.1	Go	373	10.7	Br
407	8.1	Pt	419	10.8	Fd	394	14.2	Bf	405	11.3	By	363	5.1	Go	375	10.6	Br
409	8.1	Pt	423	10.7	L	406	12.9	Bl	410	10.4	Pt	381	5.5	Go	375	10.8	Ch
410	8.1	Pt	436	8.7	L	407	12.6	En	412	10.9	Ah	398	5.3	Go	377	10.3	Br
411	8.1	Pt	437	9.4	Fd	410	13.0	Pt	412	10.5	Fd	423	5.5	Go	379	10.4	Br
412	8.4	Pt	438	9.3	An	413	12.8	Bl	415	11.0	By	429	5.3	Go	384	10.0	Pt
413	8.4	Pt	438	9.3	Gt	413	12.8	En	416	11.1	Ch	430	5.5	Go	386	10.3	Br
414	8.6	Pt	439	9.5	Fd	419	12.8	En	419	10.5	Fd	**SS HER**			389	9.7	Br
418	8.3	Pt	442	8.7	Sp	421	12.5	Bl	423	10.1	Ah	162807			392	9.8	Br
420	8.4	Pt	443	8.2	Pt	**W CRB**			436	9.9	Fd	380	9.3	Pt	395	9.6	Br
421	8.4	Pt	444	8.2	L	161138			437	10.1	Fd	388	10.4	L	396	9.6	Br
422	8.4	Pt	444	8.7	Fd	370	9.2	Br	437	9.9	Ah	393	11.1	L	398	9.3	Sp
423	7.9	L	448	9.1	Gt	371	9.2	Br	438	9.8	Ch	410	12.3	Pt	407	9.1	Fd
424	8.7	Pt	450	8.5	Fd	373	9.1	Br	439	10.0	Fd	414	12.5	Eb	410	8.5	Pt
425	8.5	Pt	451	8.7	Fd	375	9.3	Br	441	8.9	Wk	414	12.4	Kz	410	8.7	Sp
433	8.7	Pt	452	8.4	Fd	379	9.4	Br	441	10.0	Ah	423	12.8	L	417	8.2	Ch
434	8.7	Pt	452	8.2	L	380	10.0	Pt	442	9.9	Fd	424	12.6	An	433	8.0	Ch
435	9.0	Pt	456	8.4	Fd	386	9.7	Br	443	10.0	Pt	437	12.1	Be	437	8.0	Fd
436	8.4	L	457	8.2	Fd	389	9.9	Br	443	9.8	Jo	437	11.9	An	439	8.1	Fd
437	8.5	Pt	459	7.9	L	392	10.4	Br	444	9.8	Fd	437	12.0	Gt	442	8.2	Sp
439	9.1	Pt	462	8.2	Fd	395	10.4	Br	444	10.6	By	437	11.6	L	443	8.0	Pt
442	8.9	Pt	465	8.1	Fd	396	10.4	Br	445	10.0	Ah	441	11.7	Wk	443	7.9	Jo
443	8.8	Pt	466	8.1	Fd	405	11.0	Sp	449	9.7	Jo	443	11.2	Pt	448	8.2	Ch
444	9.0	Pt	467	7.5	P	407	11.0	Fd	450	9.6	Fd	444	11.3	L	449	8.1	Jo
444	8.9	L	467	8.1	Fd	410	11.0	Pt	451	9.9	Fd	446	10.3	An	450	8.2	Fd
445	8.7	Pt	469	8.0	Fd	413	11.3	Sp	452	10.0	Fd	454	9.6	L	451	8.2	Fd
447	8.6	Pt	470	8.3	Fd	414	11.1	Kz	452	9.5	Jo	**T OPH**			452	8.0	Jo
450	8.8	Pt	471	8.4	Fd	414	11.3	Eb	455	9.7	Fd	*162815*			455	8.3	Fd
451	8.7	Pt	471	7.7	Sp	441	12.1	Wk	456	9.5	Fd	384	11.5	Pt	456	8.2	Fd
452	8.5	Pt	472	8.3	Fd	443	12.8	Pt	457	9.7	Fd	386	11.5	Bl	465	8.4	Fd
452	8.5	L	474	8.3	Fd	**W OPH**			458	10.8	By	388	11.6	L	466	8.7	Fd
456	8.5	Pt	**R SCO**			*161607*			462	9.4	Fd	388	11.9	Lg	467	8.5	Fd
457	8.4	Pt	*161122a*			388	13.1	L	464	10.5	By	395	11.6	Bl	469	8.5	Fd
458	8.4	Pt	378[	14.2	Bf	388	12.7	Lg	464	9.9	P	406	11.8	Bl	470	8.6	Fd
459	8.4	L	379[	12.6	En	410	11.4	Pt	465	9.8	Fd	413	12.0	Bl	471	8.4	Fd
460	8.3	Pt	380[	12.4	Sm	415	11.3	Lg	466	9.8	Fd	419[	13.8	Lg	471	8.9	Sp
461	8.2	Pt	384	14.0	Bf	417	10.6	Ch	467	9.8	Fd	423	12.4	L	472	8.4	Fd
462	8.2	Pt	385[	12.6	Ht	431	10.7	L	467	10.0	P	437	13.5	L	**R UMI**		
465	8.3	Pt	386[	12.6	Sm	435	10.0	Ch	469	9.9	Fd	444	13.4	L	163172		
467	8.1	Pt	386	13.1	Bl	441	9.5	Lg	470	9.8	Fd	449[	13.0	Lg	391	10.3	By
468	8.4	Pt	386[	12.6	En	443	10.2	Pt	471	9.7	Fd	**S OPH**			405	10.3	By
469	8.4	Pt	394	13.9	Bf	444	9.8	Be	471	9.8	Jo	*162816*			413	10.1	Wy
470	8.4	Pt	398[	12.5	Bf	444	10.0	An	472	9.4	Fd	386	13.3	Bl	415	9.5	By
471	8.0	Pt	406[	13.2	Bl	444	10.3	Gt	474	9.7	Fd	388	12.6	L	420	10.1	Wy
W SCO			407[	12.6	En	444	9.7	L	479	9.3	By	406	10.5	Bl	427	10.1	Wy
160519			410	13.6	Pt	448	10.3	Ch	**Y SCO**			413	10.0	Bl	431	10.0	Wy
386[	13.0	Bl	413	12.6	En	453	10.2	L	*162319*			419	10.5	Lg	434	9.9	Wy
406[	13.0	Bl	413	12.7	Bl	467	9.9	Lg	388	11.5	L	421	9.4	Bl	441	9.2	Wy
RU HER			416	12.2	Sm	**V OPH**			418	11.8	L	423	9.3	L	444	9.4	By
160625a			416[	12.6	Ht	*162112*			436	12.7	L	437	9.3	L	451	9.5	By
379	12.5	Pt	419	12.6	En	380	7.2	Pt	444	13.0	L	444	9.4	L	458	9.5	By
388	12.9	L	421	12.2	Bl	410	7.4	Pt	**g HER**			449	9.8	Lg	464	9.6	By
394	12.9	L	423	12.1	Sm	414	8.1	Kz	162542			454	9.2	L	479	9.6	By
394	12.1	Gt	443	11.9	Pt	414	8.3	Eb	341	4.9	Go	**W HER**			**R DRA**		
407	11.3	Fd	**S SCO**			443	7.3	Pt	343	4.9	Go	163137			163266		
410	11.7	Sp	*161122b*			448	8.2	Ch	347	4.8	Go	364	11.0	Ch	364	7.9	Ch
410	12.2	Pt	378[	14.2	Bf				348	5.1	Go	370	11.0	Br	382	8.3	Wd
412	11.5	Fd	384	14.4	Bf				349	5.0	Go	371	10.9	Br	384	8.7	Pt

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J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
R DRA	RR OPH	RR SCO	TT DRA	RU SCO	UY DRA
163266	*164319*	*165030*	171157	*173543*	175458b
390 8.4 Fd	437 12.6 L	420 9.5 En	386 9.5 Br	390 11.9 Bl	418 11.0 Ch
391 8.9 Wd	423 11.8 L	421 9.3 Dr	392 9.5 Br	395 11.5 Bl	420 11.5 Lg
392 9.1 Wd	438 12.6 An	421 9.4 Bl	395 9.5 Br	406 11.2 Bl	467 10.0 Lg
395 8.5 Fd	438 12.5 Gt	423 9.5 Sm	396 9.4 Br	413 11.2 Bl	RY HER
397 8.5 Fd	443 13.4 Pt	441 10.8 Lg	Z OPH	421 11.2 Bl	175519
399 9.4 Wd	444 13.5 L	SS OPH	171401	SV SCO	384 13.5 Pt
400 9.9 Lj	S HER	*165202*	410 12.6 Pt	*174135*	412 13.8 Pt
401 9.6 Ah	164715	384 11.9 Pt	441 12.2 Lg	390[13.2 Bl	417 11.0 Ch
403 10.0 Lj	384 12.0 Pt	388 11.5 Lg	443 12.6 Pt	406[12.7 Bl	444 11.7 Pt
407 9.4 Fd	405 12.8 By	410 8.5 Pt	467 11.2 Lg	W PAV	R PAV
408 9.5 Fd	410 12.4 Pt	420 8.4 Lg	472 11.6 Sp	*174162*	*180363*
410 10.6 Lj	415 12.8 By	443 8.8 Pt	RS HER	370 8.4 Ht	381 12.3 Dw
410 10.4 Pt	418 12.0 Ch	RV HER	171723	374 8.1 Bl	382 12.5 Ht
415 10.0 Jo	420 12.0 Wy	165631	384 7.7 Pt	375 8.4 Ht	386 12.3 Ht
417 10.8 Ch	441 10.8 Wy	384 14.7 Pt	410 8.9 Pt	380 8.5 Sm	386 12.2 Sm
419 10.9 Lj	443 11.0 Pt	410 13.4 Pt	427 9.4 Wy	381 8.4 En	404 11.0 Dr
423 11.3 Lj	444 10.4 By	438 11.3 An	431 9.4 Wy	382 8.5 Ht	406 11.3 En
426 11.2 Lj	458 10.0 By	438 11.0 Gt	434 9.5 Wy	386 8.6 Ht	413 11.0 En
429 11.3 Lj	464 9.6 By	443 10.7 Pt	441 9.7 Wy	386 8.5 Sm	413 10.7 Dr
437 11.4 Lj	472 9.2 By	444 10.7 By	443 10.1 Wy	386 8.5 Bl	416 11.3 Ht
437 11.9 Fd	479 9.0 By	448 10.6 An	443 10.3 Pt	386 8.6 En	416 11.1 Sm
447 11.5 Ch	RS SCO	452 9.9 Jo	467 12.2 Lg	394 8.5 Sm	419 10.7 En
451 11.8 Pt	*164844*	458 10.9 By	472 12.0 Kz	395 8.6 Bl	421 10.4 Dr
452 11.8 Lj	404 12.0 Dr	464 11.8 By	S OCT	397 8.7 Ht	423 10.5 Sm
454 11.9 Lj	406 12.0 En	472 11.6 By	*172486*	406 9.1 En	T HER
TX DRA	406 12.2 Bl	472 11.5 Cl	375 13.0 Ht	406 9.4 Bl	180531
163360	413 12.0 Bl	479 11.8 By	380 13.0 Dr	413 9.8 Bl	384 9.8 Pt
370 8.1 Br	413 12.0 En	RT SCO	382 13.0 Ht	413 9.5 En	386 9.5 Fd
373 8.1 Br	413 11.9 Dr	*165636*	386 12.9 Ht	416 9.9 Ht	388 10.2 L
392 7.8 Br	419 12.0 En	374 8.5 Bl	386 12.8 Sm	416 9.9 Sm	395 10.9 Fd
395 7.7 Br	421 11.8 Dr	386 8.8 Bl	390 12.6 Bl	420 9.7 En	397 11.0 Fd
396 7.7 Br	421 11.9 Bl	395 9.3 Bl	395 12.5 Bl	421 9.9 Bl	407 11.9 Fd
S DRA	RR SCO	406 9.3 Bl	404 11.7 Dr	423 10.1 Sm	410 11.6 Al
164055	*165030*	413 9.8 Bl	404 12.1 En	RS OPH	412 12.5 Pt
405 8.2 By	374 6.8 Bl	421 9.9 Bl	406 11.7 Dr	174406	418 12.3 Ch
415 8.0 By	375 7.3 Ht	R OPH	406 11.7 Bl	384 11.1 Pt	423 12.7 L
444 7.9 By	379 7.4 Dr	*170215*	410 11.6 En	412 11.1 Pt	426 12.4 Be
451 7.9 By	379 7.2 En	418 11.8 Ch	413 11.6 Bl	444 11.1 Pt	426 10.5 An
464 7.6 By	380 7.6 Sm	436 10.2 Wb	416 10.9 En	U ARA	437 12.5 An
479 7.9 By	381 7.4 Dr	441 9.3 Wk	421 10.5 Bl	*174551*	437 12.5 Gt
RR OPH	381 7.4 Dw	443 9.6 Pt	421 10.5 Dr	379 12.3 En	437 12.5 L
164319	382 7.9 Ht	446 9.2 Ch	423 10.1 Sm	386 11.9 En	443 11.6 Hs
378 10.3 Bf	386 7.5 Ht	472 9.0 Wd	RU OPH	386 12.0 Sm	444 12.3 Pt
379 10.2 En	386 7.5 Bl	RT HER	172809	394 11.0 Sm	444 11.7 L
380 10.8 Sm	386 7.3 En	170627	384 13.5 Pt	406 8.4 En	447 11.3 An
384 10.6 Pt	386 7.7 Sm	384 9.3 Pt	412 13.0 Pt	413 8.0 En	452 11.3 L
384 10.5 Bf	394 7.9 Sm	409 8.9 Cl	438 11.7 An	416 8.4 Sm	459 10.3 L
386 11.0 Sm	395 8.0 Bl	410 9.3 Pt	438 11.6 Gt	420 8.2 En	465 9.8 Fd
386 10.6 En	397 8.8 Ht	443 9.6 Pt	444 11.3 Pt	423 8.2 Sm	466 9.6 Fd
388 10.6 L	404 8.4 Dr	RW SCO	447 11.6 An	RT OPH	467 9.4 Fd
394 11.2 Sm	406 8.9 Dr	*170833*	RT SER	*175111*	468 9.5 Hs
394 11.2 Bf	406 9.0 Bl	390[13.5 Bl	*173212*	389 13.7 Lg	469 9.3 Fd
398 10.8 Bf	407 8.8 En	406[13.0 Bl	388 11.9 L	420[14.0 Lg	470 9.1 Fd
407 11.2 En	413 9.2 En	TT DRA	423 11.9 L	T DRA	471 8.9 Fd
410 12.0 Pt	413 9.2 Dr	171157	437 12.3 L	175458a	W DRA
413 11.7 En	413 9.2 Bl	370 9.3 Br	458 12.4 L	418 12.0 Ch	180565
416 12.0 Sm	416 9.5 Sm	373 9.4 Br		420 11.6 Lg	384 11.5 Pt
419 11.8 En	416 9.7 Ht	377 9.4 Br		467 12.2 Lg	412 13.8 Pt

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J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
X DRA	SV HER	RV LYR	R SCT	R SCT	R SCT
180666	182224	184134	*184205*	*184205*	*184205*
384 11.3 Pt	388 12.7 Pt	444 10.5 Pt	419 5.5 Pt	439 7.0 Ch	457 5.4 Fd
NOV OPH	418 13.7 L	R SCT	419 5.4 Lj	440 7.3 Lj	458 5.4 Fd
180911	437 13.9 L	*184205*	419 5.1 Fd	441 7.0 Lg	458 5.0 Lj
384[12.0 Pt	444 14.1 L	377 6.0 Ch	420 5.5 Lj	441 7.0 Be	458 5.2 Pt
412[12.0 Pt	452 14.1 L	379 5.6 Pt	420 5.7 An	441 6.9 An	458 5.6 Gt
444[13.0 Pt	T SER	386 5.8 Gb	420 5.5 Pt	441 6.6 Gt	459 5.6 Fd
TV HER	182306	387 6.0 Pt	421 5.2 Pt	442 7.0 An	459 5.3 Lg
181031	444 12.1 Pt	388 6.0 Pt	421 5.9 Lg	442 6.9 Pt	460 5.3 Lg
388[14.1 L	471[11.5 Sp	388 5.4 Sp	421 5.8 An	442 7.0 Sp	460 5.5 Fd
416 11.8 L	SS SGR	388 5.6 L	422 5.6 Pt	442 5.9 Fd	460 5.0 Pt
437 10.1 L	*182416*	389 5.8 Pt	422 5.3 Fd	443 7.0 Jo	461 5.0 Pt
444 9.7 L	444 9.7 By	389 5.6 Lg	424 5.8 An	443 7.0 Pt	461 5.4 Fd
452 9.7 L	464 10.2 By	390 5.6 Lg	424 5.6 Pt	444 6.8 Lg	462 5.4 Fd
459 9.6 L	472 10.2 By	390 5.8 Pt	425 5.4 Pt	444 6.9 Be	462 5.2 Pt
RY OPH	479 9.9 By	391 5.3 Sp	425 6.0 An	444 7.0 An	464 5.3 Lg
181103	RZ HER	392 5.0 L	425 5.1 Fd	444 7.0 Gt	465 5.8 Gb
384 10.1 Pt	183225	393 5.9 Pt	425 5.5 Ch	444 6.9 Pt	465 5.2 Lg
412 13.0 Pt	468 10.8 Lg	393 5.6 Lg	426 6.1 An	444 6.0 Fd	465 5.0 Pt
444 13.7 Pt	472 11.0 Kz	394 5.9 Pt	426 5.8 Lj	445 6.8 Lg	465 5.3 Fd
W LYR	X OPH	399 5.6 Pt	427 5.8 Lj	445 6.8 Be	466 5.2 Fd
181136	183308	400 5.2 Sp	428 5.8 Lg	445 7.0 An	466 5.2 Lg
388 8.1 Pt	388 7.9 L	400 5.4 Pt	429 5.8 Bh	445 7.0 Gt	466 5.2 Gy
408 8.2 Sw	388 8.0 Pt	400 5.1 Lj	429 5.4 Fd	445 6.7 Pt	467 5.0 Lg
410 8.4 Al	411 7.3 Al	403 4.9 Lg	429 5.9 Lj	446 6.8 An	467 5.2 Fd
412 8.3 Pt	412 8.1 Pt	405 5.2 Sp	430 5.3 Fd	446 6.1 Gs	467 5.1 Pt
415 8.3 Jo	415 8.5 Jo	405 5.1 Fd	431 5.5 Fd	446 6.7 L	468 5.0 Lg
420 8.9 Wy	418 7.7 L	405 5.3 Pt	431 6.5 Wy	447 6.6 Lg	468 5.2 Pt
420 9.1 An	420 8.4 An	407 5.2 Pt	432 5.9 Bh	448 6.3 An	469 5.0 Fd
427 9.1 Wy	431 8.3 Wy	407 4.9 Lj	433 5.5 Fd	448 6.7 Gt	469 5.3 Pt
431 9.4 Wy	433 8.4 An	407 5.8 Gb	433 6.5 Gb	449 6.5 Gt	470 5.3 Pt
433 9.4 An	436 8.3 Jo	407 5.2 Fd	433 6.1 Pt	449 6.4 Lg	470 5.1 Fd
434 9.9 Wy	437 7.7 L	408 5.0 Fd	433 6.1 An	449 6.0 Jo	470 6.0 Gb
441 10.2 Wy	441 7.9 Wy	408 5.3 Sw	434 6.8 Bh	449 5.7 An	471 5.2 Pt
442 10.1 An	442 8.6 An	409 5.2 Pt	434 5.9 Fd	450 5.8 Gb	471 5.4 Fd
443 9.9 Jo	443 8.0 Jo	409 5.0 Fd	435 7.0 Wd	450 6.0 Lj	471 5.1 Sp
443 10.3 Wy	444 7.8 Pt	410 5.1 Fd	435 6.7 Pt	450 6.1 Pt	471 5.9 Kr
444 10.1 Pt	446 7.5 L	410 5.4 Sp	435 6.9 An	450 5.8 Fd	471 6.0 Jo
449 10.0 Jo	449 8.0 Jo	410 5.4 Lj	436 6.6 Pt	451 5.7 Fd	472 5.2 Fd
455 11.2 An	452 7.6 Jo	410 5.2 Pt	436 6.1 Lg	451 5.9 Lj	472 5.2 Wd
472 12.6 Kz	452 7.2 L	411 5.2 Pt	436 6.6 Jo	451 5.9 An	472 5.0 Jn
RV SGR	455 7.9 An	411 5.1 Lj	436 7.2 Wd	451 5.8 Pt	472 5.0 Kz
182133	471 7.4 Jo	411 5.0 Fd	436 5.7 Fd	452 5.6 Pt	472 5.2 Sp
380 13.3 Dr	T AQL	412 4.9 Fd	437 6.6 Pt	452 5.8 Jo	474 5.1 Fd
381 13.0 Dw	184008	412 5.3 Pt	437 7.1 Lj	452 5.7 Lj	RW LYR
381 13.2 Dr	415 9.1 By	413 5.4 Pt	437 6.8 Be	452 6.1 Gt	184243
390 12.7 Bl	444 9.6 By	413 6.0 Wd	437 6.5 An	452 5.8 Fd	388 13.0 Pt
395 12.2 Bl	464 9.1 By	413 5.0 Fd	437 6.7 L	452 5.7 L	444 12.6 Pt
404 11.9 Dr	479 9.3 By	413 5.3 Sp	437 6.9 Sp	453 5.3 Sp	NOV AQL
406 11.6 Bl	RS DRA	413 5.3 Sw	437 6.6 Gt	453 6.0 Gt	184300
413 11.0 Bl	184074	414 4.9 Fd	437 5.8 Fd	454 5.7 Lj	379 11.6 Pt
415 10.2 Dr	370 8.9 Br	414 4.8 Eb	438 6.3 An	454 6.0 Gt	387 11.7 Pt
421 10.1 Dr	373 8.8 Br	414 4.9 Kz	438 6.5 Gt	455 5.7 An	390 11.5 Pt
421 10.4 Bl	380 9.0 Br	414 5.5 Pt	439 5.8 Fd	455 5.6 L	393 11.5 Pt
441 8.7 Lg	392 9.1 Br	415 5.5 Lg	439 6.7 Pt	455 5.7 Fd	407 11.5 Pt
467 8.1 Lg	395 9.2 Br	416 5.7 Ch	439 7.3 Lj	456 5.5 Fd	408 11.1 Sp
SV HER	396 9.2 Br	417 5.7 An	439 6.8 Lg	456 5.2 Pt	410 11.6 Pt
182224		418 5.2 L	439 6.7 Be	457 5.2 Pt	416 10.6 Ch
388 12.6 L		418 5.4 Pt	439 6.8 An	457 5.0 Wd	418 11.3 Pt

Variable Star Observations Received During July and August, 1928.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
Nov Aql	Z Lyr	RW Sgr	W Aql	RY Sgr	T Sgr
184300	185634	*190819a*	*191007a*	*191033*	*191124*
424 11.7 Pt	446[14.0 L	388 9.7 Pt	388 9.1 Pt	400 6.2 Pt	379 11.0 Dr
428 11.1 Lg	452 14.8 L	396 9.7 Ch	412 9.7 Pt	400 6.4 Dr	386 10.3 Bl
429 11.1 Bh	RT Lyr	414 10.2 En	417 10.2 Ch	404 6.3 Dr	389 10.2 En
434 11.5 Pt	185737	420 10.4 En	421 9.9 Lg	406 6.6 Dr	395 10.3 Bl
441 10.6 Lg	377[11.1 Ch	421 10.1 Lg	438 10.5 Ch	406 6.3 En	404 9.2 Dr
442 11.4 Pt	416[12.0 Ch	438 10.7 Ch	444 10.5 Pt	406 6.2 Bl	407 9.6 Bl
442 11.3 Sp	420[13.3 Ch	444 10.5 Pt	464 10.6 By	407 6.2 Pt	413 9.3 Bl
445 10.7 Lg	444 12.5 By	445 10.6 Ch	467 11.6 Lg	409 6.2 Pt	414 9.8 En
447 11.4 Pt	445 12.9 Ch	449 10.2 Lg	472 11.4 Kz	413 6.3 En	415 9.3 Dr
449 10.8 Lg	464 11.1 By	464 9.4 By	472 10.6 By	413 6.9 Bl	420 9.8 En
451 11.5 Pt	472 11.2 By	467 9.1 Lg	479 11.4 By	414 6.2 Pt	421 9.5 Bl
465 11.5 Pt	479 11.0 By	472 9.2 By	TY Aql	415 6.3 Dr	— Sgr
466 10.6 Lg	R Aql	479 9.0 By	*191007b*	416 6.5 Ch	*191133*
468 11.6 Pt	190108	TY Aql	464 10.1 By	416 6.5 Sm	404 9.3 Dr
471 11.2 Sp	377 6.8 Ch	190907	472 10.2 By	420 6.5 Dr	406 9.3 Dr
RX Lyr	388 6.6 Pt	388 10.6 Pt	479 10.1 By	420 6.3 En	413 9.3 Dr
185032	399 6.5 Ah	412 10.4 Pt	T Sgr	421 6.6 Dr	415 9.4 Dr
420 13.5 Ch	404 6.6 Ah	421 10.7 Lg	*191017*	421 6.3 Pt	420 9.3 Dr
444 11.8 Ch	406 6.4 Ah	444 10.0 Pt	388 12.3 Pt	421 6.2 Bl	421 9.4 Dr
444 11.9 Pt	410 6.3 Ah	467 9.9 Lg	412 12.5 Pt	422 6.3 Pt	423 9.3 Dr
S CrA	411 6.3 Ah	472 10.9 Kz	438 11.8 Ch	423 6.5 Sm	424 9.4 Dr
185437a	412 6.1 Pt	S Lyr	444 11.6 Pt	423 6.5 Dr	S Sgr
390 12.1 Bl	416 5.8 Ch	190925	448 11.7 Ch	424 6.3 Pt	*191319a*
407 11.5 Bl	416 6.3 Ah	388 13.4 L	R Sgr	425 6.5 Ch	390[12.7 Bl
413 11.5 Bl	419 6.4 Ah	416 11.8 Ch	*191019*	433 6.2 Pt	407[13.4 Bl
421 11.9 Bl	423 6.3 Ah	420 12.6 Wy	367 8.2 Ch	434 7.3 Bu	444 12.6 Pt
ST Sgr	424 6.0 Ch	423 12.2 L	372 7.8 Ch	434 6.2 Pt	SW Sgr
1855512a	427 6.4 Ah	437 12.5 L	388 7.7 Pt	435 6.3 Pt	*191331*
388 12.1 L	430 6.5 Ah	441 11.6 Wy	396 8.0 Ch	436 6.2 Pt	382 12.1 Bl
389 13.0 Lg	436 6.7 Ah	444 12.4 Pt	407 8.6 Ch	437 6.3 Pt	407[12.9 Bl
416 9.0 Ch	437 6.9 Ah	446 12.8 L	410 8.6 Sp	438 6.8 An	TZ Cyg
421 8.5 Lg	438 7.2 Ch	448 12.7 Ch	412 8.4 Pt	438 6.5 Ch	191350
424 8.0 Ch	440 7.4 Ah	452 12.9 L	424 9.4 Ch	438 7.1 Gt	388 10.5 Pt
437 7.3 L	441 7.4 Ah	X Lyr	425 9.4 Ch	439 6.2 L	391 11.0 Sp
438 8.2 Ch	444 6.7 Pt	190926	438 10.0 Ch	442 6.2 Pt	410 10.8 Sp
441 8.0 Lg	445 7.4 Ah	388 8.9 Pt	442 10.5 Sp	443 6.4 Pt	412 10.2 Pt
446 7.4 L	450 7.6 Ah	412 9.1 Pt	444 10.4 Pt	444 6.3 Pt	442 10.6 Sp
452 7.9 L	V Lyr	415 9.3 By	445 10.6 Ch	444 6.3 L	444 10.3 Pt
459 8.2 L	190529a	444 9.0 Pt	RY Sgr	445 6.2 Pt	472 11.0 By
467 8.7 Lg	388 13.2 Pt	467 9.1 By	*191033*	448 6.5 Gt	472 10.9 Sp
R CrA	412 12.2 Pt	472 8.8 By	370 6.5 Ht	450 6.2 Pt	U Lyr
1855537a	444 12.1 Pt	479 8.7 By	374 6.3 Bl	451 6.3 Pt	191637
390 12.8 Bl	RX Sgr	RS Lyr	379 6.4 Dr	452 6.2 Pt	388 10.5 Pt
407[13.0 Bl	*190818*	190933a	379 6.3 En	452 6.8 Gt	412 11.2 Pt
413 12.5 Bl	412 9.9 Pt	377 11.1 Ch	380 6.4 Dr	452 6.4 L	444 11.5 Pt
T CrA	414 11.8 En	420 12.8 Ch	381 6.5 Sm	455 6.3 L	T Sge
1855537b	420 11.0 En	444 12.3 Pt	385 6.5 Ht	456 6.3 L	191717
390 13.2 Bl	421 11.2 Lg	RU Lyr	386 6.5 Sm	456 6.3 Pt	405 9.5 By
407[13.0 Bl	438 10.4 Ch	190941	386 6.3 En	458 6.2 Pt	415 9.4 By
413[12.5 Bl	444 10.1 Pt	421 14.0 Lg	386 6.5 Bl	460 6.2 Pt	467 9.8 By
Z Lyr	445 10.3 Ch	467 13.1 Lg	388 6.5 L	461 6.4 Pt	479 9.0 By
185634	449 9.9 Lg	U Dra	390 6.3 Pt	462 6.2 Pt	AF Cyg
388 12.2 L	464 10.0 By	190967	390 6.8 Dw	465 6.6 Pt	192745
388 12.2 Pt	467 9.8 Lg	412 13.1 Pt	390 6.7 Dr	467 7.0 Lg	370 7.0 Br
412 12.8 Pt	472 10.0 By	448 13.7 Ch	392 6.4 L	468 6.4 Pt	373 7.1 Br
423 14.1 L	479 10.2 By	451 13.8 Pt	394 6.5 Sm	469 6.5 Pt	379 7.2 Br
437[14.0 L			395 6.3 Bl	470 6.5 Pt	392 7.2 Br
444 13.6 Pt			397 6.5 Ht	471 6.6 Pt	396 7.3 Br

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1928.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
TY CYG	R CYG	RT CYG	χ CYG	RU SGR	R CAP
192928	193449	194048	194632	*195142*	*200514*
407 9.9 Ch	429 9.6 Wd	414 8.3 Fd	415 5.7 Jo	386 7.8 Sm	390 13.0 Pt
410 9.8 Sp	431 9.7 Fd	415 7.8 Jo	417 6.0 Ch	386 8.0 En	421 13.2 Lg
417 9.7 Ch	433 9.6 Fd	419 8.1 Fd	419 6.2 Ah	386 8.0 Bl	421 13.0 Pt
427 9.7 Wy	433 9.9 Jn	424 7.9 Ch	419 6.3 An	394 8.1 Sm	445 13.3 Pt
431 9.7 Wy	434 9.8 Fd	427 8.2 Wy	425 6.6 Ch	395 8.4 Bl	S AQL
441 9.9 Wy	436 9.7 Jo	429 8.4 Fd	427 6.6 Wy	397 8.8 Ht	200715a
444 9.5 Ch	436 9.9 Wd	430 8.4 Ah	427 6.7 Ah	406 9.5 En	370 10.4 Br
444 9.5 Pt	437 9.8 Fd	431 8.1 Fd	430 7.1 Sw	407 9.3 Bl	377 9.6 Ch
448 9.9 Wy	438 9.9 Ch	433 8.4 Fd	430 7.3 Wd	413 9.4 Bl	379 9.8 Br
472 11.0 Sp	439 9.8 Fd	433 8.4 Ch	431 7.0 Wy	413 10.1 En	386 9.7 Br
RT AQL	440 10.1 Ah	436 8.5 Jo	431 6.8 Be	420 10.2 En	389 9.5 Br
193311	441 10.0 Wk	437 8.8 Fd	431 7.0 An	421 10.2 Bl	389 9.1 Lg
389 13.5 Lg	441 9.8 Wy	439 8.9 Fd	436 6.6 Jo	423 9.7 Sm	390 9.4 Pt
444[13.4 Ch	443 9.8 Jo	440 8.8 Ah	437 7.2 Ah	RS AQL	392 9.5 Br
445[13.2 Lg	444 9.9 Pt	441 9.1 Wy	439 7.3 Sb	*195308*	395 9.6 Br
472 12.3 By	445 10.4 Ah	441 9.1 Wk	439 7.2 Ch	421 11.8 Lg	396 9.6 Br
SV AQL	448 10.1 Wy	443 9.8 Jo	440 7.3 Ah	NOV CYG	413 9.4 Pt
193411	449 9.9 Jo	444 9.0 Pt	441 7.6 An	195553	421 9.2 Lg
472 10.9 By	452 10.2 Jo	445 9.3 Ah	441 7.6 Gt	379[12.2 Pt	444 11.6 Ch
479 11.1 By	455 10.3 Sb	447 9.3 Ch	442 7.4 Sp	387[12.2 Pt	445 11.3 Pt
R CYG	472 10.5 Jn	448 9.2 Wy	443 7.1 Jo	405[12.2 Pt	448 11.5 An
193449	472 11.1 Sb	449 9.2 Jo	444 7.6 Pt	418[12.2 Pt	467 11.6 Lg
363 8.2 Ch	472 11.0 Kz	472 10.9 Kz	445 7.3 Ah	434[12.2 Pt	472 11.0 Cl
377 8.8 Ch	RV AQL	TU CYG	448 7.7 Wy	448[13.0 Ch	RW AQL
386 8.2 Fd	193509	194348	449 7.5 Jo	451[12.4 Pt	200715b
390 8.1 Fd	390 10.2 Pt	363[11.2 Ch	449 7.5 Ch	468[12.2 Pt	389 8.4 Lg
390 8.3 Pt	390 10.3 Lg	390 12.0 Pt	455 8.3 An	Z CYG	390 9.3 Pt
395 8.4 Fd	413 12.1 Pt	405 11.6 Ch	456 7.9 Sb	195849	413 9.5 Pt
397 9.4 Fd	444 13.6 Pt	413 11.0 Pt	470 9.5 Sb	377 11.6 Ch	420 8.7 Lg
397 9.1 Wd	T PAV	416 11.0 Ch	472 9.0 Sp	390 11.5 Pt	445 9.3 Pt
399 9.1 Wd	*193972*	424 10.4 Ch	472 9.0 Wd	413 12.6 Pt	467 9.2 Lg
399 9.0 Ah	380 13.5 Dr	433 9.5 Ch	S PAV	444 12.7 Pt	472 9.5 Cl
403 8.2 Sb	381 13.7 Dr	444 9.0 Pt	*194659*	S TEL	R TEL
404 9.1 Ah	385[13.2 Ht	447 9.0 Ch	380 6.9 Dr	*195855*	*200747*
405 9.1 Ch	390[13.2 Bl	448 9.6 Wy	388 7.0 En	390 13.0 Bl	390[13.5 Bl
405 8.8 Fd	394 12.1 Sm	472 9.6 Kz	404 7.2 Dr	407 13.0 Bl	407[13.5 Bl
407 8.4 Fd	407[13.2 Bl	472 9.7 By	407 6.9 En	421[12.6 En	RU AQL
408 8.5 Fd	415 13.7 Dr	X AQL	414 7.4 En	SY AQL	200812
409 8.8 Fd	420 13.2 En	194604	415 6.9 Dr	200212	421 9.1 Lg
410 8.9 Fd	RT CYG	411[10.2 Ah	420 6.9 Dr	388 12.7 L	W CAP
410 8.9 Sb	194048	χ CYG	421 7.5 En	390 12.4 Pt	*200822*
411 9.2 Ah	363 8.4 Ch	194632	RR SGR	413 13.0 Pt	390 12.7 Pt
411 9.4 Fd	377 8.0 Ch	363 4.8 Ch	*194929*	421[14.1 Lg	390 13.0 Bl
411 9.7 Al	386 7.8 Fd	368 5.1 Ch	380 7.4 Dr	423 13.9 L	407[12.8 Bl
412 9.5 Fd	390 7.6 Pt	374 5.0 Ch	386 7.3 Bl	437 14.1 L	Z AQL
413 9.6 Fd	395 7.7 Fd	388 5.1 Sp	395 6.5 Bl	444 13.3 Pt	*200906*
413 9.7 Jn	397 7.7 Fd	390 5.3 Pt	400 6.4 Dr	446 14.0 L	378 10.1 Bf
413 9.0 Pt	405 7.8 Ch	396 5.4 Ch	407 6.8 Bl	455 14.5 L	384 10.1 Bf
413 9.5 Sw	407 7.5 Fd	398 5.3 Sp	413 6.2 Bl	467 13.3 Lg	390 10.7 Pt
414 9.7 Fd	409 8.0 Fd	406 5.9 Ah	413 6.7 Dr	S CYG	398 11.0 Bf
415 9.0 Jo	410 8.3 Fd	408 5.6 Sp	420 6.5 Dr	200357	421 13.0 Lg
419 9.6 Ah	411 8.0 Al	411 5.9 Ah	421 6.2 Bl	377 10.5 Ch	421 12.8 Pt
419 9.7 Fd	411 7.7 Ah	412 5.6 Sp	RU SGR	390 10.9 Pt	445 12.6 Pt
422 9.5 Fd	411 8.4 Fd	412 5.9 Sb	*195142*	413 11.4 Pt	R SGE
424 9.8 Ch	412 8.1 Fd	413 6.4 An	370 7.2 Ht	416 11.6 Ch	*200916*
427 9.8 Wy	413 8.2 Fd	413 6.4 Wd	374 7.2 Bl	444 13.0 Ch	472 9.1 Cl
427 9.4 Ah	413 7.5 Pt	413 5.7 Pt	381 7.8 Sm	445 13.4 Pt	
429 9.7 Fd	413 7.8 Sb	414 5.9 Sp	385 7.9 Ht		

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1928.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
RS CYG	R DEL	U CYG	ST CYG	T DEL	S IND
200938	*201008*	201647	202954	204016	*204054*
363 8.5 Ch	442 11.3 Sp	412 8.0 Fd	390 11.2 Pt	390 9.7 Pt	400 7.3 Dr
367 8.6 Ch	444 11.4 Ch	413 8.0 Fd	413 11.3 Pt	413 10.6 Pt	395 7.5 Bl
368 8.6 Ch	445 11.3 Pt	413 8.8 Wd	420 10.9 Wy	439 12.2 An	407 7.5 Bl
370 8.1 Ch	446 11.4 An	413 7.9 Pt	441 10.8 Wy	445 12.2 Ch	413 8.3 Bl
372 7.8 Ch	446 11.3 L	414 7.8 Fd	445 10.5 Pt	445 12.6 Pt	413 7.9 Dr
374 7.8 Ch	455 11.0 L	415 8.0 Jo	448 10.6 Wy	448 12.2 An	420 8.2 Dr
377 7.8 Ch	471 10.1 Sp	419 8.8 Ah	472 10.0 By	472[12.8 Cl	421 8.3 Bl
388 7.7 L	RT CAP	419 7.8 Fd	V VUL	V AQR	X DEL
390 7.4 Pt	*201121*	422 7.8 Fd	203226	204102	205017
392 7.6 L	421 6.3 Pt	423 8.2 Ah	390 8.5 Pt	390 8.1 Pt	445 12.6 Pt
396 8.1 Ch	SX CYG	424 8.2 Ch	413 8.9 Pt	421 8.1 Lg	RR CAP
398 7.6 Sp	201130	427 8.2 Ah	445 8.8 Pt	421 8.0 Pt	*205627*
400 7.5 Sp	390 13.6 Pt	429 8.4 Wd	R MIC	445 8.0 Pt	413[13.8 Dr
406 7.5 Sb	413 13.6 Pt	429 7.7 Fd	*203429*	467 8.9 P	420[13.7 Dr
407 7.0 Gb	445 13.7 Pt	430 7.9 Fd	390 12.8 Bl	W AQR	R VUL
407 8.2 Ch	RT SGR	431 7.8 Fd	395 12.0 Bl	*204104*	205923a
408 8.1 Ch	*201139*	433 7.7 Fd	407 12.3 Bl	378 9.0 Bf	377 8.1 Ch
408 7.2 Al	386 11.8 Bl	434 7.8 Fd	413 11.7 Bl	384 8.8 Bf	390 8.8 Pt
413 7.8 Sb	395 12.2 Bl	435 8.0 Fd	421 10.4 Bl	392 8.9 L	399 9.4 Ah
413 7.3 Pt	405 12.7 Dr	436 7.9 Fd	Y DEL	398 8.9 Bf	413 11.1 Pt
415 7.4 Jo	407 12.7 Bl	436 8.3 Jo	203611	424 9.1 L	446 12.8 Pt
416 7.7 Ch	413 12.7 Dr	436 9.2 Wd	421 12.2 Lg	439 9.4 L	RS CAP
417 7.7 Ch	420 13.0 Dr	437 8.7 Ah	468[13.5 Lg	449 9.4 L	*210116*
424 7.2 Ch	WX CYG	437 7.7 Fd	472[12.5 Cl	456 10.0 L	439 8.1 An
424 7.3 L	201437b	439 7.8 Fd	S DEL	U CAP	V CAP
425 7.5 Ch	388 10.4 L	440 8.2 Ah	203816	*204215*	*210124*
433 8.0 Ch	390 10.5 Pt	442 8.0 Sp	390 9.3 Pt	390 13.6 Bl	390[13.0 Bl
433 7.2 Gb	392 10.8 L	442 7.9 Fd	407 10.1 Lj	412[12.2 Bl	412[12.5 Bl
436 7.4 Jo	408 11.3 Al	443 7.9 Jo	413 9.8 Pt	421 13.4 Lg	TW CYG
438 7.8 Ch	410 11.2 Sp	444 7.8 Fd	419 10.4 Lj	468[13.6 Lg	210129
439 7.2 L	413 11.5 Pt	445 8.1 Pt	426 10.5 Lj	V DEL	410[11.5 Sp
442 7.3 Sp	417 11.6 Ch	445 8.2 Ah	445 10.3 Pt	204318	444 11.8 Sp
443 7.4 Jo	424 10.8 L	446 8.4 Ah	452 10.7 Lj	421[14.0 Lg	472 10.4 Sp
444 7.3 Be	439 11.9 L	450 8.4 Ah	454 10.9 Lj	468[13.5 Lg	X CAP
444 7.5 An	445 12.3 Ch	449 7.9 Jo	458 11.1 Lj	T AQR	*210221*
444 7.3 Gt	445 11.9 Pt	453 7.2 Gu	468 10.8 Lg	*204405*	390[12.7 Bl
445 7.4 Pt	446 11.8 L	454 8.4 Ah	V CYG	390 7.7 Pt	412[12.7 Bl
446 7.4 L	455 12.0 L	458 8.5 Wd	203847	396 8.0 Ch	RS AQR
447 7.2 Ch	U CYG	459 7.8 Fd	377 10.2 Ch	407 8.2 Fd	*210504*
448 7.2 Ch	201647	460 7.9 Fd	390 9.0 Pt	408 8.2 Sp	390 11.4 Pt
449 7.4 Jo	363 9.4 Ch	471 8.4 Sp	407 10.0 Ch	421 8.8 Lg	392 10.4 L
449 7.2 Ch	390 8.1 Pt	U MIC	413 8.5 Pt	421 8.4 Pt	421 10.2 Pt
455 7.3 L	390 8.0 Fd	*202240*	415 10.0 Jo	424 8.7 Ch	424 10.2 L
456 8.2 Sb	395 8.1 Fd	390[13.6 Bl	424 10.2 Ch	436 9.8 Sw	439 10.7 L
470 8.7 Sb	397 8.1 Fd	404[12.5 Dr	436 10.5 Jo	439 10.0 An	447 10.4 Pt
471 7.3 Jo	397 8.4 Wd	407[13.0 Bl	438 10.0 Ch	442 10.2 Sp	449 10.6 L
472 7.3 Sp	398 8.0 Sp	420 11.5 Dr	445 8.7 Pt	445 10.3 Pt	456 10.8 L
R DEL	404 8.9 Ah	RW CYG	Y AQR	447 9.8 Ch	Z CAP
201008	405 7.9 Fd	202539	*203905*	467 12.0 Lg	*210516*
388 12.7 L	407 7.9 Fd	437 10.2 Gt	378[14.5 Bf	472[12.7 Sb	384[13.0 Bf
390 13.0 Pt	407 7.5 Gb	438 10.2 An	384 14.9 Bf	RZ CYG	390 13.0 Pt
413 12.8 Pt	407 9.2 Ch	448 10.2 An	390[11.0 Pt	204846	421 13.1 Lg
424 12.6 An	408 7.2 Al	RU CAP	398[14.5 Bf	390 12.0 Pt	421 13.1 Pt
424 12.0 L	408 7.9 Fd	*202622*	407[12.0 Fd	413 11.9 Pt	447 10.4 Pt
424 12.6 An	409 7.8 Fd	384 11.8 Bf	421 12.0 Lg	445 11.6 Pt	R EQU
437 11.7 An	410 7.9 Fd	398 12.7 Bf	456[12.0 Fd	S IND	210812
437 11.7 Gt	411 8.2 Ah		467 11.7 Lg	*204954*	421 13.5 Pt
439 11.3 L	411 8.0 Fd			390 7.5 Bl	447 12.0 Pt

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J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
T CEP	T CEP	W CYG	V PEG	S LAC	V CAS
210868	210868	213244	215605	*222439*	230759
367 9.7 Ch	457 7.6 Fd	433 6.3 An	421 10.1 Lg	424 12.1 L	421 10.0 Pt
377 9.4 Ch	458 7.5 Fd	437 6.3 An	421 10.1 Pt	426 11.5 Be	W PEG
386 8.8 Fd	458 6.5 Sb	441 6.4 An	442 7.9 Sp	426 11.7 An	451 11.7 Pt
390 8.6 Fd	459 7.6 Fd	444 6.3 An	447 7.8 Pt	437 11.9 Gt	231425
390 8.5 Pt	460 7.7 Fd	444 5.7 L	467 8.2 Lg	437 11.9 An	439 9.3 An
395 8.7 Fd	460 8.0 Wd	449 5.7 L	471 8.1 Sp	439 12.4 L	467 12.6 Lg
396 8.6 Ch	462 7.7 Fd	455 6.5 An	U AQR	446 12.6 An	S PEG
397 9.1 Fd	465 7.5 Fd	457 5.5 L	*215717*	450 13.0 L	231508
401 8.6 Ah	466 7.4 Fd	459 5.6 L	390 11.5 Pt	451 12.4 Pt	393 10.0 Pt
406 8.3 Ah	466 8.0 Gy	S CEP	421 11.1 Lg	456 12.6 L	420 9.7 Wy
407 8.6 Fd	467 7.3 Fd	213678	421 11.2 Pt	R IND	421 9.3 Pt
408 8.5 Fd	469 7.5 Fd	390 9.0 Pt	447 11.0 Pt	*222867*	441 8.6 Wy
408 8.5 Sw	470 7.6 Fd	421 9.8 Pt	RT PEG	372 9.6 Dr	451 8.6 Pt
409 8.7 Fd	471 7.4 Fd	443 9.8 Jo	215934	394 9.5 Bl	V PHE
410 8.7 Fd	472 7.3 Sb	447 10.6 Pt	451 11.0 Pt	386 9.9 Bl	*232746*
411 8.4 Ah	472 7.4 Fd	449 10.0 Jo	RY PEG	395 10.4 Bl	372 10.0 Dr
411 8.8 Fd	472 8.1 Wd	RU CYG	220133a	407 11.3 Bl	405 9.0 Dr
412 8.8 Fd	474 7.7 Fd	213753	421 12.0 Pt	414 11.2 Dr	413 9.5 Dr
413 8.6 Fd	RR AQR	390 8.4 Pt	451 12.2 Pt	420 13.0 Dr	Z AND
413 8.6 Sb	*210903*	417 8.9 Ch	RZ PEG	421 12.5 Bl	232848
414 8.6 Fd	390 13.5 Pt	421 8.6 Pt	220135b	T TUC	393 9.7 Pt
415 7.5 Jo	421 13.7 Lg	441 8.5 Wk	421 11.8 Pt	*223462*	421 9.5 Pt
419 8.0 Ah	421 13.6 Pt	447 8.4 Pt	451 11.5 Pt	370 10.9 Ht	451 9.7 Pt
419 8.5 Fd	447 13.5 Pt	RV CYG	T PEG	385 10.9 Ht	ST AND
424 8.0 Ch	X PEG	213937	220412	404 8.8 Dr	233335
421 7.4 Pt	211614	388 6.9 L	388 10.1 L	413 8.7 Dr	393 8.6 Pt
425 8.0 Ch	390 10.9 Pt	390 6.3 Pt	424 11.3 L	416 8.4 En	403 8.9 Lg
425 8.4 Fd	421 12.5 Pt	421 6.4 Pt	439 12.4 L	R LAC	420 8.7 Wy
427 7.6 Ah	447 13.5 Pt	424 6.6 L	449 12.7 L	223841	421 9.1 Lg
429 8.4 Fd	T CAP	439 6.9 L	456 13.2 L	388 11.1 L	421 8.3 Pt
430 7.9 Fd	*211615*	447 6.7 Pt	Y PEG	424[14.0 L	441 8.4 Wy
431 7.9 Fd	390[12.7 Bl	452 7.2 L	220613	439 13.7 L	444 9.1 Ch
433 7.7 Fd	412[12.3 Bl	RR PEG	421 10.4 Pt	450 14.0 L	451 8.3 Pt
434 7.9 Fd	S MIC	214024	451 10.9 Pt	RW PEG	468 8.8 Lg
436 7.9 Fd	*212030*	390 13.3 Pt	RS PEG	225914	R AQR
436 6.8 Jo	390 10.7 Bl	421[13.7 Lg	220714	421 13.8 Pt	*233815*
436 8.3 Wk	395 9.7 Bl	421 13.5 Pt	393 11.2 Pt	451 11.0 Pt	390 6.0 Bl
436 7.4 Ah	405 8.7 Dr	447 12.6 Pt	421 12.0 Pt	472 10.5 Sp	412 6.7 Bl
437 7.8 Fd	407 8.8 Bl	467 9.6 Lg	451 12.1 Pt	R PEG	421 7.3 Pt
439 7.9 Fd	413 8.6 Bl	479 9.1 By	T GRU	230110	424 7.5 L
440 7.4 Ah	413 8.7 Dr	μ CEP	*221938*	393 7.9 Pt	439 8.7 An
441 7.6 Ah	420 8.4 Dr	214058	416 8.8 En	421 7.8 Pt	439 7.7 L
441 8.1 Wk	421 8.3 Bl	441 4.4 Wk	S GRU	423 8.1 Ah	442 7.8 Sp
442 7.9 Gy	Y CAP	R GRU	*221948*	437 8.3 Ah	444 7.9 Ch
442 7.7 Fd	*212814*	*214247*	370 8.2 Ht	440 8.6 Ah	449 7.7 L
443 7.9 Sb	390 12.0 Bl	370 7.7 Ht	372 7.9 Dr	445 8.6 Ah	449 8.2 An
443 7.0 Jo	412 12.6 Bl	372 7.6 Dr	385 8.4 Ht	450 8.9 Ah	451 8.0 Pt
444 8.0 Ch	W CYG	385 8.0 Ht	404 9.3 Dr	451 8.7 Pt	456 7.9 L
444 8.0 Fd	213244	386 8.1 Bl	418 10.0 En	467 8.7 Lg	459 8.1 L
445 7.3 Ah	388 6.4 L	395 8.3 Bl	420 9.7 Dr	470 9.5 Gb	472 8.2 Sp
446 7.6 Ah	392 6.3 L	404 8.5 Dr	RV PEG	V CAS	Z CAS
449 7.1 Jo	419 6.5 An	407 8.5 Bl	222129	230759	233956
450 7.5 Ah	420 6.6 An	413 8.8 Bl	410[11.4 Sp	393 8.4 Pt	421 12.9 Lg
450 7.8 Fd	421 6.3 An	416 8.8 En	S LAC	401 9.2 Ah	468 10.0 Lg
451 7.6 Fd	423 5.8 L	420 9.3 Dr	222439	406 9.5 Ah	472 11.1 By
452 7.7 Fd	424 6.3 An	421 9.2 Bl	388 8.7 L	408 9.5 Sw	RR CAS
453 7.5 Ah	427 6.2 An		393 9.0 Pt	411 9.8 Ah	235053
456 7.7 Fd	431 6.0 L		421 10.8 Pt	419 10.0 Ah	414 12.8 Bn

Variable Star Observations Received During July and August, 1928.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
RR Cas	V Cet	V Cet	R Cas	Z Peg	SV And
235053	*235209*	*235209*	235350	235525	233959
443 11.6 Bn	390 12.8 Bl	439 13.6 Cl	445 12.2 Ah	393 10.9 Pt	393 12.5 Pt
	412 12.7 Bl	455 13.3 L		421 9.0 Pt	421 11.5 Pt
				451 8.6 Pt	451 9.8 Pt
					468 8.7 Lg

Rapidly Varying Irregular Variables.

Star	J.D.	Est.Obs	J.D.	Est.Obs.	Star	J.D.	Est.Obs.	J.D.	Est.Obs.
005840 RX Andromedae—					202946 SZ Cygni—				
	5388.8	12.5 Pt	5443.7	12.4 Pt		5435.7	8.8 Pt	5456.8	9.5 Pt
	5390.8	11.5 Pt	5444.7	12.4 Pt		5436.8	9.0 Pt	5458.7	**9.7 Pt**
	5393.8	11.3 Pt	5447.8	12.4 Pt		5437.7	9.0 Pt	5460.7	8.8 Pt
	5418.8	11.5 Pt	5450.8	11.4 Pt		5439.7	9.5 Pt	5461.7	8.7 Pt
	5421.8	11.6 Pt	5451.8	11.5 Pt		5442.7	9.5 Pt	5462.7	8.6 Pt
	5424.9	11.7 Pt	5452.8	11.6 Pt		5443.7	9.6 Pt	5465.7	9.4 Pt
	5436.8	11.0 Pt	5465.7	11.7 Pt		5444.7	9.2 Pt	5467.7	9.3 Pt
	5437.7	11.0 Pt	5468.7	11.7 Pt		5445.7	9.2 Pt	5468.7	9.5 Pt
	5442.7	12.2 Pt	5470.7	11.3 Pt		5447.8	8.9 Pt	5469.7	9.5 Pt
060547 SS Aurigae—						5450.8	9.0 Pt	5470.7	9.5 Pt
	5370.1	14.5 Bf	5396.4	12.4 L		5451.8	9.4 Pt	5471.7	9.5 Pt
	5374.1	11.6 Ch	5398.7	11.0 Pt		5452.7	9.5 Pt		
	5376.1	15.2 Bf	5407.7	12.4 Pt	213843 SS Cygni—				
	5379.4	13.9 L	5409.4	12.0 L		5363.4	8.3 Ch	5408.7	11.8 Sp
	5380.4	13.9 L	5413.7	12.4 Pt		5368.4	8.3 Ch	5409.4	11.5 L
	5381.4	13.0 L	5439.6	12.0 L		5374.4	9.2 Ch	5409.6	11.9 Cl
	5383.7	14.1 Lg	5449.6	12.4 L		5379.7	11.7 Pt	5409.7	11.8 Pt
	5384.7	12.6 Pt	5451.6	12.4 Pt		5381.4	11.5 Gt	5409.7	11.6 Fd
	5386.7	11.0 Pt	5452.6	13.3 L		5371.4	11.4 L	5410.4	11.8 Lj
	5388.7	14.0 Lg	5455.6	13.9 L		5386.7	11.7 Pt	5410.4	11.5 Be
	5389.1	13.9 Bf	5456.6	13.9 L		5386.7	11.0 Gb	5410.4	11.4 L
	5390.4	13.0 L	5457.6	14.5 L		5387.8	11.7 Pt	5410.7	11.7 Fd
	5394.4	13.0 L	5459.6	13.3 L		5388.5	11.6 L	5410.7	11.7 Pt
	5395.4	12.4 L				5388.8	11.6 Pt	5410.8	11.6 Sp
074922 U Geminorum—						5389.0	11.9 Lg	5411.4	11.8 Lj
	5370.1	9.6 Bf	5388.8	14.0 Lg		5389.8	11.7 Pt	5411.4	11.5 An
	5374.1	12.4 Ch	5389.1	14.0 Bf		5390.4	11.6 Gt	5411.4	11.4 Be
	5376.1	13.5 Bf	5393.8	14.0 Lg		5390.4	11.6 L	5411.7	11.8 Fd
	5379.1	14.0 Ch	5394.1	13.7 Bf		5390.8	11.7 Pt	5412.7	11.6 Fd
	5380.1	13.7 Bf	5404.8	14.0 Lg		5391.4	11.7 An	5412.7	11.7 Pt
	5383.8	14.0 Lg				5391.4	11.7 L	5413.4	11.1 An
132003 W Virginis—						5392.5	11.5 L	5413.7	11.6 Fd
	5388.7	9.5 Lg	5415.7	9.1 Lg		5393.8	11.7 Pt	5413.7	11.7 Pt
	5391.7	10.0 Sp				5394.5	11.4 L	5414.7	11.4 Fd
202946 SZ Cygni—						5394.5	11.4 Gt	5414.8	11.7 Pt
	5379.7	9.2 Pt	5409.7	9.4 Pt		5395.8	11.7 Pt	5415.4	11.7 Lj
	5384.7	9.5 Pt	5410.7	9.5 Pt		5397.7	11.6 Pt	5416.2	11.9 Ch
	5386.7	9.0 Pt	5411.7	9.5 Pt		5399.6	11.4 L	5418.8	11.5 Pt
	5378.8	8.9 Pt	5412.7	9.4 Pt		5400.4	11.8 Lj	5419.4	11.4 Lj
	5388.8	9.0 Pt	5413.7	9.5 Pt		5400.8	11.7 Pt	5419.4	11.0 An
	5389.8	9.1 Pt	5414.8	9.4 Pt		5401.4	11.8 Lj	5419.7	11.6 Fd
	5390.8	9.3 Pt	5418.8	9.2 Pt		5403.1	12.0 Lg	5420.2	11.9 Ch
	5393.8	9.4 Pt	5420.7	9.4 Pt		5403.4	12.0 Lj	5420.4	11.1 An
	5395.8	9.5 Pt	5421.7	9.0 Pt		5404.4	11.4 L	5420.4	11.7 Lj
	5397.8	9.5 Pt	5422.7	9.4 Pt		5405.7	11.7 Pt	5420.7	11.7 Pt
	5398.7	9.6 Pt	5424.9	9.6 Pt		5407.4	11.5 Lj	5421.1	11.8 Lg
	5400.8	8.9 Pt	5425.7	9.5 Pt		5407.7	11.8 Pt	5421.4	11.3 An
	5405.7	9.4 Pt	5433.7	8.9 Pt		5407.7	11.7 Fd	5421.7	11.7 Pt
	5407.7	9.2 Pt	5434.7	9.1 Pt		5407.7	11.0 Gb	5422.6	11.7 Fd

RAPIDLY VARYING IRREGULAR VARIABLES.

Star	J.D.	Est.Obs	J.D.	Est.Obs.	Star	J.D.	Est.Obs.	J.D.	Est.Obs.
213843 SS CYGNI—					213843 SS CYGNI—				
	5422.7	11.7 Pt	5439.4	11.8 Lj		5448.4	8.4 An	5457.6	8.1 Fd
	5423.4	11.8 Lj	5439.4	12.0 Be		5448.4	8.4 Gt	5457.6	8.5 By
	5423.4	11.3 L	5439.4	11.5 An		5448.6	8.5 Wy	5457.6	8.8 L
	5424.4	11.1 An	5439.5	11.5 L		5449.2	8.3 Ch	5457.7	9.0 Pt
	5424.9	11.8 Pt	5439.7	11.8 Fd		5449.3	8.5 L	5458.4	8.3 Pt
	5425.2	11.8 Ch	5439.7	11.7 Pt		5449.5	8.4 An	5458.4	9.0 L
	5425.7	11.7 Pt	5439.8	11.8 Ah		5449.5	8.2 Gt	5458.4	8.9 Lj
	5426.4	11.8 Lj	5440.4	11.8 Lj		5449.7	8.3 Jo	5458.4	8.9 Ah
	5426.4	11.6 An	5441.4	11.4 Gt		5449.8	8.1 Lg	5458.6	8.8 Fd
	5426.4	11.5 Be	5441.4	11.9 An		5450.4	8.4 Lj	5458.6	8.8 By
	5427.4	11.8 Lj	5441.5	11.8 Ah		5450.4	8.3 Ah	5458.7	9.0 Pt
	5427.4	11.8 An	5441.9	11.6 Wk		5450.7	8.1 Fd	5459.3	9.3 L
	5428.4	11.9 An	5442.4	11.5 An		5450.8	8.4 Pt	5459.6	8.4 Fd
	5428.8	11.9 Lg	5442.7	11.8 Sp		5451.3	8.4 Lj	5460.6	9.6 Fd
	5429.4	11.7 Lj	5442.7	11.7 Pt		5451.5	8.4 An	5460.6	10.1 By
	5431.4	11.9 L	5442.7	11.7 Fd		5451.6	8.1 By	5460.7	9.8 Pt
	5431.4	11.8 Lj	5443.7	11.7 Pt		5451.7	8.2 Fd	5461.6	10.5 Fd
	5431.7	11.7 Fd	5444.4	11.2 Gt		5451.8	8.4 Pt	5461.7	10.0 Pt
	5432.7	12.0 Bh	5444.4	11.3 L		5452.4	8.1 Gt	5462.7	10.7 Pt
	5433.4	11.7 An	5444.4	12.0 Be		5452.4	8.3 Lj	5464.6	11.7 By
	5433.7	11.7 Fd	5444.4	11.4 An		5452.5	8.7 L	5465.7	11.6 Pt
	5433.7	11.6 Pt	5444.6	11.8 Sp		5452.6	8.3 By	5466.7	11.7 Fd
	5433.7	11.9 Bh	5444.7	11.8 Sp		5452.7	8.4 Jo	5466.8	11.9 Lg
	5434.7	12.0 Bh	5444.7	11.6 Pt		5452.7	8.1 Fd	5467.1	12.0 Pt
	5434.7	11.8 Pt	5444.7	11.6 Fd		5452.7	8.5 Pt	5467.7	11.7 Pt
	5435.7	11.7 Pt	5444.7	11.2 By		5452.7	8.1 Fd	5467.8	12.0 Lg
	5436.4	11.3 L	5444.8	11.4 Lg		5452.7	8.5 Pt	5468.7	11.8 Pt
	5436.5	11.8 Ah	5445.4	10.9 Gt		5453.4	8.2 Gt	5468.7	11.7 By
	5436.7	11.6 Fd	5445.4	10.2 Ah		5453.4	8.5 Lj	5468.8	11.9 Lg
	5536.8	11.6 Pt	5445.4	10.9 Be		5453.4	8.5 Ah	5469.7	11.8 Pt
	5437.4	11.2 L	5445.4	10.9 An		5453.6	8.3 By	5469.7	11.9 Fd
	5437.4	11.8 Lj	5445.6	9.7 By		5453.7	8.1 Fd	5470.7	11.8 Pt
	5437.4	11.8 Ah	5445.7	10.3 Pt		5454.4	8.6 L	5470.7	12.0 Fd
	5437.4	11.3 An	5445.8	9.4 Lg		5454.4	8.2 Gt	5471.1	11.8 P
	5437.5	11.5 Gt	5446.2	9.7 Ch		5454.4	8.4 Lj	5471.7	11.9 Fd
	5437.7	11.7 Pt	5446.4	9.7 Ah		5454.4	8.5 Ah	5471.7	11.8 Pt
	5437.7	11.7 Fd	5446.4	9.3 An		5455.3	8.6 L	5472.6	11.8 Sp
	5437.9	11.9 Wk	5446.8	9.0 Lg		5455.4	8.4 An	5472.6	12.0 Cl
	5438.4	11.5 Gt	5447.4	8.8 An		5455.7	8.2 Fd	5472.7	12.0 By
	5438.4	11.4 An	5447.8	8.4 Lg		5456.7	8.2 Fd	5473.6	12.1 By
	5439.2	11.8 Ch	5447.8	9.0 Pt		5456.8	8.9 Pt		

SUMMARY OF OBSERVATIONS.

Observer	Initial	Vars.	Observations	Observer	Initial	Vars.	Observations
Ahnert	Ah	23	159	Dartayet	Dr	62	297
Allen	Al	20	26	Dawson	Dw	19	22
Ancarani	An	52	183	Ebert	Eb	5	5
Baldwin	Bl	101	378	Ensor	En	62	209
Bappu	Bf	22	64	Ford	Fd	28	497
Barry	By	20	109	Gaebler	Gb	10	20
Benini	Be	28	62	Gallanti	Gt	26	77
Beyer	Br	17	114	Gomi	Go	1	12
Brown	Bn	2	4	Goodsell	Gs	5	6
Bunch	Bh	7	13	Gregory	Gy	5	8
Bush	Bu	3	3	Gushee	Gu	2	2
Chandra	Ch	84	233	Haas	Hs	3	9
Clement	Cl	14	17	Houghton	Ht	35	119

Observer	Initial	Vars.	Observations	Observer	Initial	Vars.	Observations
Johnstone	Jn	4	10	Smith,W.H.	Sm	50	169
Jones	Jo	27	86	Soberanes	Sb	10	32
Kearons	Kr	5	5	Spears	Sp	33	89
Kurtz	Kz	15	15	Stambaugh	So	1	1
Lacchini	L	65	352	Swanson	Sw	15	22
Leiner	Lj	10	145	Waterfield	Wf	1	9
Logan	Lg	80	188	Watkins	Wk	24	27
Mardany	M	1	1	Webb	Wd	11	48
Peltier	Pt	219	842	Whitney	Wy	34	76
Pohl	P	6	8				
Smith,F.W.	Sf	11	29	Totals		46 360	4800

The European astronomical meetings are nothing but a memory now—but very pleasant ones—for those of us who were fortunate enough to be able to attend them, and many of the A.A.V.S.O. members were in attendance, both at Leiden and Heidelberg, either officially or unofficially. The opportunity to meet with the greater lights of the other variable star associations, and to discuss with them matters of mutual interest, proved most valuable, and a great incentive to closer co-operation between the three bodies. Your President and the Recording Secretary held many an informal meeting with the heads of the other organizations and we all feel that as a result of these heart-to-heart meetings, a greater spirit of friendliness and closer understanding of our motives and aims exists than formerly, to the end that variable star observing, especially among the semi-professional and amateur astronomers, will be further advanced and more real enthusiasts become interested in this delightful and useful avocation.

Plans are going ahead for the Annual meeting of the Association at Harvard on October 20 and the special feature of the evening part of the program will be a symposium, taken part in by those who attended the foreign meetings in July.

LEON CAMPBELL, Recording Secretary.

September 6, 1928.

METEOR NOTES.

By CHARLES P. OLIVIER.

*Due to the absence of the writer in Europe, where he has been attending the meetings of the International Astronomical Union and of the Astronomische Gesellschaft, it is impossible for him to review recent observations that may have been sent in by the members of the A.M.S.

However, the work of the Meteor Commission of the I.A.U. is of general interest and will form the subject of these notes. The Commission met the third day, with about half the members and a large number of visitors present. In all nine recommendations were made in the report, of which seven were adopted and two tabled, at request of certain members, until the next meeting of the I.A.U.

The latter referred to the compilation of a new catalogue of meteor radiants, only reliable ones being used; and secondly to the possible revival of the Bureau

*This portion of Meteor Notes was received too late to be used in our last number. ED.

PLATE XVI

PHOTOGRAPH OF A REMARKABLE METEOR,

taken by Issei Yamamoto, at Mukden, Southern Manchuria, on June 29, 1927, at $15^h\,51^m$, G.M.T. The meteor was —14 in stellar magnitude, outshining all street lights. The color was reddish. It is thought to be connected with the Pons-Winnecke comet. The region of the photograph is Ophiuchus and Scorpio, with Saturn and Ceres in the field.

Central Météorique. It was the opinion of the chairman, confirmed by others, that we were in no position to undertake the compilation of a catalogue, until further work had been done on the reality of radiants for which we do not have unquestionable evidence. Certain work, now being planned or actually under way, should in time lead to partial answers to the question involved.

Due to the probable entrance, in the near future, of several other countries, including Germany, into the I.A.U., the immediate attempt at revival of the Bureau Central Météorique was considered inopportune.

The Commission recommended to the General Assembly that directors of observatories, which have on file large collections of plates, be asked to have these collections examined for meteor trails. Where considerable numbers are found, plans for their study can doubtless be devised, either individually or collectively.

Photographic work, the coöperation of variable star observers for telescopic meteors, simultaneous observations by two observers for checking results, the use of three stations for real heights, and several other matters of general interest were taken up. The writer had the opportunity of personally consulting with Hoffmeister, King, Svoboda and Opik, the men who are leading authorities in meteoric astronomy in their respective countries. He was also pleased to note the increase in interest by astronomers in general, as was evidenced by opinions expressed by many others in conversation, as well as more public utterances.

Flower Observatory, University of Pennsylvania.

Due to the writer's absence from the country for most of the summer, and the disorganization of our headquarters due to moving from Virginia to Pennsylvania, this report can be only a partial one. Brief mention will be made of work received but there has been no opportunity for deducing the radiants and other results. Also extensive observations made by our most active Texas observers have not yet arrived, so must be reviewed later.

A letter of June 8 from Dr. W. J. Fisher at Harvard College Observatory said that watches on June 5 and 7 failed to detect any meteors from the hypothetical swarm connected with Skjellerup's comet. At Fort Worth, Texas, O. E. Monnig reported that results on June 6 and 8 were strictly negative. It is evident that our earth passed through no shower connected with this comet.

At Danneviske, New Zealand, Ivan L. Thompsen observed March 1, from 14:25 to 16:05, fair sky, seeing 18 meteors; March 22, 9:54 to 10:52, clear, 9 meteors; March 27, 14:40 to 16:47, clear, 26 meteors.

At Auckland, New Zealand, R. A. McIntosh observed May 31, 3:00 to 4:10, N. Z. C. T., moon until 3:25, clear, 21 meteors; June 12, 2:30 to 3:20, crescent moon, clear, 10 meteors.

At Rockville Center, L. I., N. Y., Alfred S. Lawrence observed June 6, 14:40 to 15:30 E.S.T., sky poor, 4 meteors; June 15, 13:00 to 15:00, clear, 7 meteors.

At Ann Arbor, Mich., Clinton B. Ford, one of our new members, observed Aug. 11, 10:10 to 14:14 C.S.T., very clear, 53 meteors; Aug. 12, 11:22 to 14:22, clear, 41 meteors. He reported also 13 casuals and 4 telescopic meteors seen earlier in the year. A glance at his magnitude column would indicate that the meteors on Aug. 11 and 12 averaged quite bright. We hope this observer will continue his work, so well begun. Practically all meteors mentioned in the above four reports are plotted on the accompanying maps.

From others, not members, the following notes are taken:

At Cambridge, Ohio, Mrs. J. R. Burney, on Aug. 11, 12:30 to 13:00, saw 9,

one a brilliant meteor. She observed from a north window and saw only a limited portion of the sky.

At Westminster, S. C., Oscar Tuck observed on Aug. 11 from 14:00 to 14:45, seeing from 35 to 40 meteors, 4 bright, one a fireball.

A press clipping from Portland, Oregon, signed Bob Swayze reports that on Aug. 12 he saw 17 meteors in a watch of one and one-half hours. Three were bright, one a dazzling object. The hours were not given.

At North Stamford, Conn., J. V. McClees observed on Aug. 13, 11:55 to 13:45, fair sky, 16 meteors; Aug. 16, 13:05 to 14:58, poor sky, 13 meteors; Aug. 20, 11:00 to 13:07, fair sky, 11 meteors.

Through the Weather Bureau, Hydrographic Office, and individuals we have recently received detailed observations of brilliant meteors or fireballs on the following dates: Feb. 15; April 4, 21, 23, 25; May 5, 13, 27, 29; June 12, 13, 19; July 13, 24, 28, 28; and August 7, 8, 9, 12 and 17. We earnestly request the cooperation of all persons in securing data on such objects so that their heights and orbits may be calculated.

We welcome as new members: F. B. Eaton, 309 Thompson St., East Point, Georgia, and G. H. Lutz, 1107 City Center Bldg., Philadelphia, Pennsylvania.

Recent reports from Meteor Crater, Arizona, inform us that the vertical shaft has been sunk 420 feet. It will be remembered that this shaft is about one-fifth mile south of the crater rim, and eventually must be sunk to the 1400-foot level. Then the horizontal shaft will be driven north to the meteoric mass. The strata so far penetrated give no evidence of shattering action at this distance from the crater.

In the June *National Geographic Magazine* an article appeared dealing with Meteor Crater and its discovery. The writer notes with regret that this article nowhere mentions the fact that the meteoric origin was first proved by D. M. Barringer, to whose efforts indeed the scientific world owes most of the explorations carried out in that locality.

An even more serious matter is that this article inferentially gives the credit of the meteoric theory of its origin to another prominent scientist therein named, who in fact used his influence in trying to prove quite a different theory, having rejected the meteoric or impact theory. This may be clearly read in the latter's publications, and is well known to all of us who have taken the trouble to inform ourselves in the matter.

In a few weeks it is hoped that all the records and other property of the A.M.S. will have arrived here and once more be in order. Meanwhile there will be unavoidable delays in filling requisitions and replying to inquiries. Again a most cordial invitation is issued to persons, interested in meteoric astronomy, to join the American Meteor Society.

University of Pennsylvania, Flower Observatory,
Upper Darby, Pennsylvania, 1928 September 19.

GENERAL NOTES.

Assan Dina, Hindu owner of Mont Blanc Observatory, died suddenly at Cruseilles, Switzerland. He had begun the construction of a larger observatory on Mont Saleve, France, to cost $6,250,000, to be equipped with the world's largest telescope (diameter 105 inches).—(*Time*, July 9, 1928.)

William Reid.—A clipping has been received from the *Cape Times* of Capetown announcing the death of Mr. William Reid on June 8. Mr. Reid was well known to the astronomical world as the discoverer of a number of comets and as one who had the unique experience of seeing a star through the bright ring of Saturn.

Sale of Chile Station of the Lick Observatory.— In the August number of *Publications A. S. P.,* President Campbell of the University of California reports the sale of this station to the Catholic University of Chile. The actual transfer of title is to take place next April.

The Eclipse of July 29, 1878.—The *Dallas News* of Dallas, Texas, devoted a full page of its issue of July 29, 1928, to incidents of the famous eclipse of 1878 when the shadow path crossed that frontier town. The expedition to Dallas, in charge of Professor David P. Todd, was sent out by the U. S. Navy.

The Rotation of Neptune.—A rotation of Neptune has always been assumed but definite proof has been lacking. A number of observers have reported periodic light variation which could be interpreted as due to rotation. Theoretical investigations based upon perturbations of the orbit of the satellite likewise indicated a rotation. In the August number, *Publications of the Astronomical Society of the Pacific,* Moore and Menzel of the Lick Observatory report that they have succeeded in determining a rotation by spectrographic means. The period is approximately 15.8 hours and the direction *direct.*

The Next Issue of Popular Astronomy will be a convention number. We shall have articles on the meetings of the International Astronomical Union at Leiden and the Astronomische Gesellschaft at Heidelberg from the pen of the Editor, Professor C. H. Gingrich, and the report of the meeting of the American Astronomical Society at Amherst from the Secretary, Professor Dugan.

COMMUNICATIONS.

Observations of the Aurora of July 7-11, 1928.

At the Detroit Observatory.

R. H. Curtiss. Observations by this observer refer to an interval from 10:45 to 11:15 P.M. E.S.T., on the evening of July 7. A notable feature at the beginning of this interval was a well-defined black arch in the south above which the auroral light was green and diffuse. Throughout nearly all of this interval a well-marked convergent of whitish or reddish rays, some of great length, was a conspicuous feature. At the epoch 11:00 P.M. E.S.T., the position of this convergent obtained by alignment with stars was: Bearing, S 3° E; zenith distance, 23°8. No variations in this position were noticed. Another notable feature during this interval was a marked red glow, stronger frequently near the convergent of the streamers but usually widely diffused. Toward the end of the interval the red glow and much of the streamer display were confined to the western hemisphere of the sky; the southern arch had disappeared. In the north there was no great accentuation

of the display, no well-marked arch, and only occasional streamers. The general illumination was frequently so great that a black and white watch face with figures 0.16 inches high could be read.

LAURA HILL MCLAUGHLIN. Observations on the night of July 7 to 8. While twilight was still quite bright, before opening the 37½-inch telescope for the night's work, I noticed in sky, extending from near the zenith toward the west, what I thought were some hazy streaks of cloud. These appeared and disappeared with rather strange frequency. As the twilight disappeared, the whole northern sky was seen to be lighted by aurora. There was a faint suggestion of red near the zenith and in the east.

By 10:45 the aurora had become so very prominent that, as work with the 37½-inch telescope permitted, I jotted down fragmentary notes of what I could see from inside the dome. This included observations of east, south and west.

At 10:47 E.S.T. in south, a strong auroral arch about 4° above Saturn.

10:48. Strong red in east. There are many streamers greenish in color. Auroral light much stronger than moonlight. Distant landscape clearly visible from east window. The slit jaws of spectroscope illuminated as at dawn.

10:50. Southern arch below Antares.

10:52. Red in west, many strong streamers in north.

10:55. Brilliant red streamers in east, faint red in west; southern arch about 5° below Antares.

10:57. Brilliant pink above; all sky seen through opening in the dome is light red.

11:02. Southern arch rising, lower edge at Antares.

11:03. Brilliant red over head. Streamers from north terminate just south of opening in dome which extends almost due east.

11:05. Aurora fading.

11:10. Southern arch gone, but red light is visible.

11:15. Red in west. Rays from north, east and west converging to point somewhat south of zenith between Ophiuchus and Hercules.

11:27. Exposure in P Cygni began.

11:37. Strong streamers from east are passing through the field.

12:04. Aurora has brightened again. There are patchy streamers in west extending to zenith and beyond. There is a faint low arch again in the south.

12:06. There are streamers now in the east.

12:30. Slit jaws quite bright with auroral light. Patches of light are visible. Landscape is again plainly visible. Moon is now contributing its light having risen about 11:45.

13:20. Slit jaws again illuminated. Moon is now very bright so that detail of aurora is somewhat masked.

13:50. Aurora is again very prominent. Slit jaws again illuminated. There are peculiar formations at the zenith with a serpent-like weaving back and forth of the streamers. The northern edge of these streamers seemed a little south of the zenith, and streamers themselves had a general east to west direction. Patchy clouds appeared in east and north, covering fairly well that region of the sky.

14:05. Slit jaws no longer illuminated.

15:42. Aurora is still strong. Flickering streamers are over greater part of sky.

As dawn progressed aurora still remained strong. The serpent-like weaving near the zenith was still visible when dawn was very bright. Streamers and

patches of auroral light could easily be mistaken for clouds so far as brightness was concerned.

D. B. McLAUGHLIN. I made no notes concerning the great display, although I observed a number of the features noted by Mrs. McLaughlin. One of the most striking features was the behavior of the streamers at the convergent near the zenith about 1:50 A.M., July 8. A broad sheet of light would suddenly appear to be torn into shreds and these would wave about as if a strong wind were blowing them. At other times an intensely brilliant greenish yellow streamer bordered by red would make its way slowly upward from a point 10° or so from the convergent, wriggling like a snake as it went. The cloud effects were especially striking at this time. Large tracts of ragged-looking clouds somewhat like altocumulus (mackerel sky) had developed in the north, east and south. The sky between clouds was entirely clear of haze. In the moonlight the clouds appeared faintly whitish, but when the green auroral glow flared behind them they were converted to a dark grey. The alternate flaring and fading of the aurora behind the clouds produced wierd effects.

The auroral streamers remained visible until they were drowned out by the light of dawn. I believe 2:00 A.M. was the time of maximum activity.

Two nights after the great display, viz., on the night of July 9-10, a solitary well-marked auroral feature was visible. It was first noticed at 1:00 A.M., E.S.T., as a great arch, bright but diffuse, extending for 60° or so across the northwest quarter of the sky and passing some distance above Polaris. This is cited from memory, as its auroral nature was not recognized at once, the observer being occupied at the 37½-inch reflector and mistaking it for a band of cloud illuminated by the moon which had already risen.

By 2:00 A.M. it had shrunk to a smaller spot in the west, as shown in the first sketch. Its auroral nature was recognized at that time, as it underwent sudden flarings and fadings. For a few minutes, about 2:10, it appeared as a smaller elliptical spot from which a short brushy flickering streamer extended. For some time afterwards it was entirely invisible, but it reappeared about 2:30. From that time on it faded rapidly and was last seen at 2:44, when it appeared as a small, very faint, nebulous spot about the stars β and γ Serpentis. Its characteristic behavior was a sudden flaring to considerable brilliancy, followed by slower fading, sometimes to total invisibility.

The accompanying sketches* were made at the time of observation, and not from memory. The observer was occupied most of the time at the telescope so that continuous observations were impossible. In the sketches, the spot is given a definiteness of outline which it did not actually possess, although it was by no means difficult to decide on its limits. Possibly the best analogy is that of the edge of the earth's shadow at a lunar eclipse, which, while indefinite, can still be represented as a sharp line.

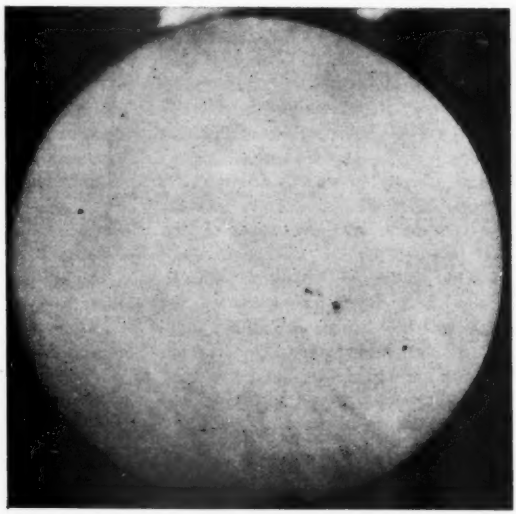
On the night of July 11, at 9:50 P.M., E.S.T., a long, cigar-shaped auroral spot was seen in the northeast just below Cassiopeia. It flared and faded as did the spot described above. The observer was then busy at the 12-inch refractor until 10:30, when either the same spot or a similar one only one-third as large was seen in the northwest just below ι and κ Ursae Majoris.

The features here described were so definite that similar observations from

*These sketches will be reproduced later if any other observers made similar ones which, when used with these, will permit determination of altitude. ED.

some other station would serve to give a good determination of their altitude, and they were so isolated that no ambiguity as to identification would be likely to arise.

JAMES H. LOGAN. Between $20^h\ 50^m$ and $22^h\ 40^m$, July 7, 1928, a rather vivid auroral display was observed from Dallas, Ft. Worth, and nearby places. This report does not presume to describe the observations made from Dallas, but refers to the sun spots of July 9 and 10.



The figure shows the entire sun on July 10. The photograph was taken with an 11-inch reflector, diaphramed down to four inches aperture, power about 40, and projection averaging about six inches. The exposure was made on *Agfa* film at 1/1000 of a second with a Graflex camera.

3514 Cedar Springs Road,, Dallas, Texas, July 14, 1928.

STERLING BUNCH. On the evening of July 7 a very brilliant display of the aurora was observed from Ft. Worth and from many different sections of this state. The aurora is of such rare occurrence in our latitude—32° 46′ north—that amateur astronomers in Dallas and Ft. Worth kept telephone wires busy in an attempt to inform everybody that the show of a lifetime was in progress.

Following are notes from the writer's observations of the display:

8:50 C.S.T. Two broad, faint streamers seen, one almost due north and nearly vertical, the other running from a point about NNW up through the bowl of the Dipper. The twilight glow at this hour was still considerable and the writer could not be sure for nearly twenty minutes whether these were light and shadow streamers from the sun or really the aurora.

9:10. The two streamers considerably brighter and a glow comparable to the zodiacal light appeared in the north.

9:10-9:55. No marked activity during this period; intermittent increase and decrease in the brilliance of the glow, with some change in shape of the streamers.

9:55. A deep red glow appeared in the northeast and spread over very nearly the entire northern sky up to the altitude of Polaris. At the same instant the typical auroral flutings appeared over a point about NE and extending around to a little west of north. The flutings showed some blue and green in subdued tone, but the red glow was the predominant color. Streamers reached well up to the zenith, while the flutings at times were within 25° of that point. The combined light was sufficient to make newspaper print readable. Maximum of activity and brilliance was reached at 10:00.

10:15. Slowly fading.

10:20. All color gone. Streamers and flutings still visible.

10:40. Still visible but faint and inactive.

O. E. Monnig, Ft. Worth, observed a reappearance of the streamers and the accompanying red glow at 11:40 which lasted five minutes.

Another observer reports that the display was still active in the early morning and that at 16:00 he arose and observed it for a few minutes. He was sufficiently aroused by the beauty of the phenomenon to note the exact time as given above. According to this observer the display was much more brilliant at this time than in the evening.

Newspaper dispatches report much interference with radio, telephone and telegraph communication in many parts of the state of Texas during evening display.

Box 86, Stockyards Station, Ft. Worth, Texas.

RUSSELL SULLIVAN. At 8:30 P.M. (Central Standard Time) two large patches of auroral haze drifted from northeast to northwest. 8:45 P.M. a bright area near Vega became a long hook, extending almost to Polaris. The hook disappeared in a few minutes.

10:00 P.M. the sky in the northeast was bright, pale green, with a red patch around Vega, and a large red area appeared in the southeast. Eight or ten long streamers, green at the base but red at the top, converging from the northwest, north and northeast, and formed a corona overhead. There was also a small auroral cloud about δ Herculis. The display faded and the sky was dark for more than an hour.

11:30 P.M. there was another brightening of greenish light in the northeast and a second corona appeared. 11:50 P.M. the head of Draco was surrounded by an area of red light and a bright vertical ray of white light flashed for a second near Polaris. 12:15 A.M., July 8, there were short auroral rays a few degrees northeast of Altair, and at 12:30 A.M. long streamers extended from the northwest to the southeast, brightening and fading, and dividing lengthwise, as they played across the sky. Clouds and moonlight obscured the end of the display.

Indianapolis, Indiana.

The Thirteenth Annual Meeting of the Optical Society of America will be held at the Bureau of Standards in Washington, November 1-3, 1928. In addition to the usual program of papers contributed by members on their own initiative, it is intended to have a well balanced program of invited papers on various outstanding topics in optics.

The exhibition will be held under the joint auspices of the Bureau of Standards and the Optical Society. It will open October 31, the day before the meeting, and will be open from 9:00 A.M. to 4:30 P.M., October 31-November 3 and one evening to be designated later.

The meeting and the exhibition will be open to non-members as well as members of the Society. All interested persons are cordially invited to attend both.

IRWIN G. PRIEST, *President.*

Telescopic Observation of a Large Daylight Meteor.

On the morning of March 11, 1928, I found my little portable equatorial out of level, and to make sure of its orientation I looked up the position of Venus in the *Nautical Almanac* and set the declination and approximate hour angle. When I looked in the finder, I had the satisfaction of seeing the tiny disc of the planet graze the declination thread.

The finder is equipped with a French objective 25 mm in diameter, and 25 cm focal length. The eyepiece is 1½-inch focal length giving a magnification of 6.6.

At about $17^h\ 23^m$ G.T. (10:23 A.M. Mountain Time) as I was bringing Venus to the intersection of the cross hairs I was surprised by the sudden entrance of a large meteor into the field, the nucleus of which made Venus appear insignificant by comparison. It was slowly moving westward on a slightly curved path nearly parallel with the parallel of declination at a rate of not more than 15′ per second.

The nucleus showed a disc comparable to that of Jupiter under a magnification of 25 diameters. The tail was short, 3° or 3½° in length, at most.

The meteor passed about 5′ south of Venus and it was a long time in the field, possibly 10 seconds, so I was able to study the wonderful object quite sufficiently for a fair description. The color of the meteor seemed to be dominated by reflected sunlight. On the forward side was an intense white blazing corona, one would say at "white heat." The nucleus appeared to be of equal brightness, fading into a less bright tone in the tail.

What held my attention most was a crescent shaped gap between the nucleus and the corona. It was sharply defined and perfect in outline, it was circular on the concave side as well as I could judge, and more like a parabola or hyperbola on the convex side. Through this gap the blue of the sky was seen.

The corona itself was a flaming, spurting fiery wheel, the outline suggesting a hill top ablaze in a calm for, and this must be noted, the blaze did not seem to be much affected by the tremendous wind one would expect, due to the velocity and the resulting atmospheric pressure. There were big flames, and little flames, rising and dying down rapidly with a rocket-like spurt between, or a flame slightly bent backward would lose its tip, the latter vanishing a short distance away.

The nucleus was rotating rapidly, ten revolutions per second or less, apparently from west to east. I had an impression of seeing one of its poles. The rapid rotation and actual changes due to what appeared to be numerous explosions at very short and irregular intervals, confused the picture considerably. A series of variations in the rate of velocity was noticeable. There variations at short and irregular intervals gave it a "halting" effect, as if some variable obstacle, some medium of varying density or some other cause checked it, gaining speed to be checked again, again spurting forward.

LOUIS SCHLOSS.

Hot Springs, Arizona.

Planet Beyond Neptune.—With reference to the series of articles by Professor Pickering regarding a planet beyond Neptune, and the search that has been made for it by some astronomers, it may be of interest to read what was written by Alexander Winchell, "Professor of Geology, Zoology, and Botany in the Universit yof Michigan, and Director of the State Geological Survey," in his

"Sketches of Creation," published in New York in 1870, page 329:

"Neptune, the remotest planet, revolves about the sun in 60.000 days—speaking in round numbers—Uranus, the next, in 30,000 days, which is one half the preceding number; Saturn, the next, in 10,000 days, which is one third the period of Uranus; Jupiter revolves in 4000 days, which is two-fifths of the period of Saturn. And so we go on through the system, and find the law expressing the relations of the revolutions of the planets identical with that which determines the arrangement of the leaves upon the humble stem of a planet. . . . Moreover, an examination of this series of fractions renders it impossible that any planet should exist exterior to Neptune, as his periodic revolution corresponds to the beginning of the series; though an indefinite number of planets may exist within the orbit of Mercury, inasmuch as the planets lying in that direction correspond to the indefinite continuation of the series. . . . Astronomers will therefore take notice, and not be found planet-hunting in the deserts of space beyond the orbit of Neptune."

ROSCOE LAMONT.

611 22nd Street, N. W., Washington, D. C., June 22, 1928.

Comment on Injuries from Meteorites.— In the March number of POPULAR ASTRONOMY is a very interesting account of a slight injury received by a Japanese child from a falling meteorite. This seems to be one of the very few recorded instances of accidents from meteorites. The two fatalities mentioned in connection with that incident as "fairly authentic" seem to me very questionable. The stones from heaven reported in the Book of Joshua are described in that book as hailstones and there is weighty evidence that they really were hailstones and not meteorites. In the Cambridge Bible, a volume of commentaries, page 86, we find: "Even ordinary hailstones in Syria are often of enormous size. None who know the tremendous power which the hailstones of the East sometimes exhibit will question the possibility that hail could produce the effect described." Moreover, when other ancient people preserved meteorites as objects of reverence, would not the Israelites have found and cherished some of the fragments sent by Jehovah to destroy their enemies if the stones had not been perishable hail? The other case cited, a fall at Mhow, India, in 1827, has for authority the article on "Meteorites" in the *Encyclopedia Brittanica*. The author of that article does not state his evidence, but as the *Edinburgh Journal of Science* of 1828 and the *Philosophical Magazine* of 1863 each describe that accident simply as a wound on the arm of a man, it seems probable that death did not result from the meteorite.

In Arago's *Astronomie Populare* is given a long list of deaths from falling meteorites including several from ancient Chinese accounts. Among the most noted are the case of two sailors and that of a monk at Milan both in the 17th century. The former was reported by a Dutch captain who said that a meteorite weighing four kilograms killed two men on the bridge of his ship while it was going at full sail. To fully allay the suspicion that the story may not have been devised to conceal the result of mutiny, one would like to know what became of the big meteorite. The story of the monk at Milan was thoroughly investigated by Chladni, an authority on meteorites in the 19th century. He considered the evidence strong that a monk had been killed by a meteorite, but that the stone preserved in a museum as the fatal one was not a meteorite. A letter published in *Comptes Rendus*, 1837, describes a fall in Brazil in which cattle were badly injured, but no people were known to have been harmed. Farrington, in his book,

"Meteorites," has well said that stories of fatalities have originated too far away in both place and time to ever be verified.

LEAH B. ALLEN.

COMET NOTES.

By G. VAN BIESBROECK.

This summer has been unusually quiet in the way of cometary activities. On June 15 Crawford secured a last observation of comet 1928 *a* (Reinmuth) with the Crossley reflector at the Lick Observatory. Since then Comet 1927 *d* (Stearns) has been the only one under observation but it has become a very inconspicuous object. As seen with the 40-inch refractor of the Yerkes Observatory during the month of September, it appeared to the writer as a diffuse coma extending in position angle 80° into a short tail some 40″ in apparent length. The total light-impression was equivalent to that of a $14\frac{1}{2}^{M}$ star. In the center of the coma there is a faint nucleus, fairly well defined but not brighter than a $15\frac{1}{2}^{M}$ star. The ephemeris given on p. 322 still holds very well. Y. C. Chang has continued it as follows:

EPHEMERIS OF COMET 1927 *d* (STEARNS).

1928 0^h U.T.	(1928.0) h m	° ′	Mag.
Sept. 22	16 30.7	+61 31	14.8
30	38.5	60 50	
Oct. 8	47.1	60 11	
16	16 56.4	59 37	
24	17 6.3	59 6	15.0
Nov. 1	16.7	58 40	
9	27.7	58 18	
17	39.0	58 2	
25	17 50.8	57 50	15.1
Dec. 3	18 2.8	57 44	
11	15.0	57 43	
19	27.3	57 47	
27	18 39.8	+57 56	15.2

In the beginning of October, 19 months after the discovery of this comet, it is at the enormous distance of six astronomical units (550 million miles) from both earth and sun. Further observations will be possible with large instruments, the comet staying circumpolar in the constellation of Draco.

It is hoped that before the end of the year the two periodic comets Holmes and Taylor may be recovered. The field of the former one as indicated by Polak's ephemeris (see p. 444) was examined photographically in September by the writer, but no clear evidence of the presence of the comet has been found.

The perturbations of Taylor's comet due to the approach of Jupiter in 1925 (minimum distance 0.24 on June 20) have been quite large so that it is difficult to predict the exact position, not to speak of the uncertainty of the original orbit deduced from the observations in 1916. Y. C. Chang and the writer have undertaken to calculate the perturbations due to Jupiter from 1916 to the present time. We expect to have these computations ready in a few days. The search will then be undertaken with a better chance of success. There is a great interest in recovering this comet so as to know what has become of the two parts into which the comet split in 1916.

Williams Bay, Wisconsin, September 23, 1928.

BOOK REVIEWS.

Life in the Stars by Sir Francis Younghusband. (E. P. Dutton & Company; Price $3.75).

"An exposition of the view that on some planets of some stars exist beings higher than ourselves, and on one a world-leader, the supreme embodiment of the eternal spirit which animates the whole." This quotation from the titlepage discloses the guiding thought in the writing of the book. It represents the result of years of thought on the part of the author and gives his philosophy of the universe, material and spiritual. His scientific groundwork is up-to-date, his reasoning is clear and his style vigorous. He is not afraid of difficulties and frankly recognizes the difference between proof, probability and mere play of the imagination. The book deserves a careful reading by everyone interested in a philosophy of the universe. E.A.F.

Elements of Astronomy (2nd Edition) by E. A. Fath. (McGraw-Hill Book Company, New York; Price $3.00).

In the second edition (1928) of "Elements of Astronomy" Dr. Fath has accomplished admirably his purpose as stated in the preface to this new edition,—to include revisions bringing the book "up-to-date" to the end of 1927. It is gratifying to note the inclusion of the recent work of Bobrovnikoff on Cometary Spectra; of Bowen on the Nebular Lines; of E. C. Slipher and Ross, of Adams and St. John on Planetary Atmospheres; of Coblentz and Lampland on Planetary Temperatures; of Gerasimoviç and Luyten on the Sun's position in the sidereal system; of Pettit and Nicholson on the Temperature of the Moon; of Brown and others on the Rotation of the Earth; of Stetson on the Total Light of the Corona; and Michelson's latest value for the Velocity of Light.

Twenty-one additional illustrations contribute to the general attractiveness of the book. Some of these are substitutions which in all cases constitute improvements, the outstanding one being Fig. 216 on the Types of Stellar Spectra by R. H. Curtiss replacing Fig. 143 of the first edition. This change was suggested by Mr. Garrett in his review of the first edition. V. M. Slipher's excellent spectrograms of Halley's Comet and Schjellerup's Daylight Comet, Figs. 146 and 147, replace a very poor one of Morehouse's Comet, Fig. 130 in the first edition. Among the additional illustrations, of especial interest are The Flash Spectrum taken by the Lick Observatory Eclipse Expedition with a moving-plate spectrograph; Ross's photographs of Venus taken with Ultra-Violet Light; and E. C. Slipher's Photographs of the Canals of Mars and his most remarkable ones of Saturn. The spectrum of Saturn, Fig. 142, illustrates well the meteoric constitution of Saturn's rings. On the other hand, such illustrations as Fig. 208, A Distant Star Cloud in Sagittarius, N.G.C. 6822, add nothing. They have lost too much in the reproduction.

Others of the additional photographs and diagrams illustrate the text in paragraphs which were not included in the first edition. Those on the subjects of Reflection of Light, Divergent Lenses, Chronometer, Sextant, and The Variation in Length of Apparent Solar Day, may be noted.

Whole subjects are rearranged and revised in their treatment, in all cases with improvement. Examples are The Atomic Theory; Theory of Relativity; Proper Motion; and the Classification and Description of Nebulae.

In his review of the first edition Professor Alter remarked the paucity of errors. Among the few, the author has caught and corrected such items as the resolving power of the 40-inch; the omission of *sidereal* day and *sidereal* year, page 143; omission of definitions of *astronomical unit, obliquity of the ecliptic*, and of *apparent magnitude;* limit —23° for the Aitken-Hussey search for double stars, page 240.

Comparable items that have not been picked up are: Page 8, "*Geocentric latitude* is the angle at the center of the earth" etc. This should read "center of figure." Page 54, "reflector" for "refractor," line 5. Line 10, "causes" should read "would cause." No mention of the term "almucantar" or "color-index"; Page 134, It is not strictly true that "the sunlight is *wholly* excluded." Page 219, "It should be noted that these parallaxes are always relative to much fainter stars of unknown but presumably much greater distance," is also not entirely in accordance with the facts. Page 82, "The apparent solar time at any instant is equal to the hour-angle of the Sun," should read "*apparent* Sun."

The writer agrees with Professor Alter's suggestion that the Law of Universal Gravitation should be presented before it is applied to the determination of the mass of the Earth, and regrets that Dr. Fath did not see fit to adopt the suggestion in the new edition. Also, Mr. Garett's suggestion to include in an appendix tables of planetary and stellar data was one that might have been followed to advantage.

By comparing the author index in the two editions one will note many merited revisions and alterations in the matter of accrediting of work. There are others which it is hoped will be caught in a third edition, for there are many names associated with important work which should be cited if the author is to be consistent.

At Northwestern University the text is used in the summer course in descriptive astronomy, where there is no mathematics pre-requisite. For this it is very satisfactory.

MAUDE BENNOT.

Dearborn Observatory, Northwestern University,
Evanston, Illinois, 28 August 1928.

The Rise of Modern Physics by Henry Crew. (The Williams & Wilkins Company, Baltimore; Price $5.00).

This book is designed primarily for those who have not had a thorough training in physics and a knowledge of the development of physical ideas. After an introductory chapter there follow others entitled Greek and Roman Science; Arabian Physics; Physics in the Middle Ages; the Birth of Modern Physics; Refraction, Dispersion and the Nature of Light; The Pioneers in Electricity and Magnetism; Discovery of the Nature of Heat; The Discrete Nature of Matter; From Volta to Oersted; Electromagnetism and The Rise of Modern Spectroscopy. Over twenty portraits of eminent physicists of the last two centuries are used as illustrations. The style is simple and the thought clear so that the book is easy to read. The story of the efforts put forth by the great leaders to reach the truth make the reader realize more than ever the debt we owe to those devoted souls who laid the foundations upon which we build today. The book closes with a discussion of the Bohr theory of the atom. We wish that the work of Schrödinger had been included. The book can be recommended to anyone interested in its subject matter and deserves a wide circulation. E.A.F.

Planet Tables, by Karl Schock. (Linser-Verlag, Berlin).

The complete title of this work, translated, is, "Planet tables for everyone for the computation of the geocentric places of the large planets (and of the moon) for the time interval from 3400 B.C. to 2600 A.D., without the use of logarithms and trigonometric functions to within the tenth of a degree, with special reference to Babylonian astronomy." The work is evidently done with very great care and an enormous amount of information is presented in the thirty pages of this quarto-sized volume.

Although it is intended for "everyone," the application of the tables would, doubtless, prove quite puzzling to ninety-nine out of every one hundred. Fortunately, usually ninety-nine out of every hundred are willing to let the remaining one do the reckoning which is necessary for their purposes.

Sir Isaac Newton, published under the auspices of The History of Science Society. (The Williams and Wilkins Company, Baltimore, Md. Price $5.00.)

The History of Science Society, in collaboration with several other scientific societies, and other organizations, arranged a two days session in commemoration of the two-hundredth anniversary of the death of Sir Isaac Newton. The meetings were held in New York City on November 25, 26, 1927. At the meetings a series of thirteen papers on the work of Newton and showing its bearing on present day science was presented. Twelve well-known American scientists contributed to the series. The readers of this magazine have alrady had access to the abstracts of these papers which were published in the January and February issues of this year. The complete papers have now been brought together in a volume and constitute an evaluation of the work of Newton two centuries after his death. In reading the various papers one is impressed by two things, first, his unusual versatility, and, second, the fact that the glory of his marvelous achievements has not been dimmed by the years.

At the beginning of the volume is found an excellent half-tone reproduction of E. Seeman's painting of Newton, now in Trinity College. Later in the book is found a very fine half-tone reproduction of the bronze statue of Newton, now in the Library of Congress, Washington. The volume is beautifully bound and in appearance as well as in content it would add lustre to any library.

1001 Celestial Wonders, by C. E. Barns. (*Science Service Press,* Morgan Hill, California. Price $2.50.)

An unusually compact volume under the above title has recently appeared. Its purpose is to serve the amateur in becoming acquainted with the sky and with the elements of astronomy. Seventy-two charts, covering the sky from the north pole to —30° in declination, give the conspicuous objects in their relative positions, and also in their correct positions in right ascension and declination. The objects charted are listed and described on an adjacent page. It thus becomes a very serviceable handbook.

Besides this feature the book contains much of interest and value to a beginner, so that one can find here at least an introduction to the terms one finds in the astronomical literature of the day. It contains a summary of the information now accepted as correct concerning the members of the solar system; a number of half-tones of celestial objects with descriptions, to prepare the amateur for what he will see in the telescope; a long list of variable stars in the Harvard nomencla-

ture; a section on instrument building with numerous charts and photographs; a description of sun-dials; and an extensive book list.

Scattered through the book are numerous quotations from past as well as from present writers on astronomical subjects. This feature lends charm and a fascination to the book, so that one eagerly turns the pages assured that he will come upon something of interest.

While it is not so stated in the volume, the reviewer is under the impression that the mechanical work also was carried out by Mr. Barns. He therefore is entitled to double credit for this unique addition to the rapidly increasing astronomical literature.

The Scientific Papers of William Parsons, Third Earl of Rosse, collected and republished by the Hon. Sir Charles Parsons. (Percy Lund, Humphries and Co. Ltd., London.)

This volume, very interesting historically, brings together the writings of the Earl of Rosse and of his collaborator Dr. T. R. Robinson. The reader naturally turns first to the paper on the construction of his mirror of six-feet aperture. One is impressed also with the wide range of his interests as is evidenced by such papers as those on Mechanical Science, Mathematics and Physics, and A Contribution to the History of Ironclads. It was a happy idea to put this material in such convenient form and thus save the student the trouble of finding it in its original form. The volume consists of 221 pages and forms a valuable addition to any astronomical library.

The Earth Upsets, by Chase Salmon Osborn. (Waverly Press, Inc., Baltimore, Md. Price $3.00.)

The title of this book evidently grows out of a sentence in the preface, viz., "There is a motion of the earth, perhaps more than one, that has not been recognized by anyone up to the present." In developing this thought the author discusses various geological conditions, past and present, and also makes use of such astronomical evidence as will contribute to his purpose.

A statement on page 42 that "there are depths in the Pacific much greater than the diameter of the moon" is hard to accept. Also on page 45 the relative masses of moon and earth are not very clearly stated. On the same page the question arises whether the comparison between the sun and moon is on the basis of mass or volume.

The book is interestingly written and stimulates thought in many directions. The final pages are given to a chronological summary of well authenticated earthquakes, beginning 425 B.C. and ending with the one in Jerusalem on July 11, 1927.

Errata,

P. 447, line 8, *for* J. Wilson Hanshaw *read* J. Wilson Hanahan.

Add the following footnotes at the bottom of p. 445:

[1] Computed from Jan. 29, Feb. 22, Mar. 19.

[2] Computed from Jan. 29, Feb. 22, Mar. 15.

[3] Computed from Jan. 29, Feb. 22, Mar. 15.